# SCIENTIFIC AMERICAN

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1. Positions of boilers, engines, guns, and air reservoirs. 2. Compressed air reservoirs. 3. Bow view. 4. Boiler room and passageway. 5. Section showing "revolvers," carrying the dynamite shells, and protective steel deck. 6. Broadside exterior view. 7. 1,500 lb. dynamite shell. Center—The dynamite guns projecting above deck.

**THE DYNAMITE CRUISER VESUVIUS.**—[See page 277.]

# Scientific American.

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(Illustrated articles are marked with an asterisk.)



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SCIENTIFIC AMERICAN SUPPLEMENT

No. 670.

**For the Week Ending November 3, 1888.**

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**THE PATENT OFFICE THE FRIEND OF THE INVENTOR.**

In the recent case of Donovan, on appeal, the Hon. Benson J. Hall, Commissioner of Patents, laid down the following excellent doctrine:

"The rules of the office, particularly rules 68 and 139, point out that at all times in the investigation of an application, and in the progress of appeals, it is the duty of each tribunal having jurisdiction of the case to see to it that the inventor shall secure a patent for whatever patentable matter may be shown in his application. As has been frequently stated by me in decisions, the office must put itself in the attitude of a friend, and not of a litigant with the applicant, and see that he secures every right that belongs to him. Not only is this true of the rules cited, but Congress has seen proper to take especial pains to provide that whenever an applicant, in consequence of any inadvertence or mistake in the framing of his specification or claim, has failed to secure that to which he is entitled, or his patent is inoperative or invalid either by reason of having claimed too much or too little, he may have the proper correction made by a reissue, which will secure him the precise invention to which he is entitled.

"Now, unquestionably, if under rules 68 and 139 it is the duty of the Examiners-in-Chief and the Commissioner to suggest and recommend, in order that an applicant may receive letters patent for subject matter not involved in the appeal, it must be the duty of the Primary Examiner in the examination of the case made by him to point out and recommend the same thing. I do not mean by this that it is the duty of the Examiner to become an agent or an attorney for the applicant; but I think in all cases when he is satisfied or believes that the application contains patentable matter which is not claimed, but which he has reason to believe the applicant is seeking to cover, it is his duty to advise the applicant briefly and specifically, precisely as the Examiners-in-Chief and the Commissioner are authorized to do, as above stated. By acting upon this principle, all of the tribunals of the office become friendly to the applicant, and enable him to clearly see and understand the views of the office as to the nature and patentability of the invention described. Such practice would undoubtedly tend to lessen the correspondence and conflicts which arise between applicants or their counsel and the office."

**LAUNCH OF A NEW TYPE OF FERRY BOAT.**

On Thursday, October 25, a double-ended propeller, designed for service on the Hoboken and New York ferries, was launched at the ship yards of Thos. C. Marvel & Co., Newburg, N. Y. While not in all respects a novelty, the boat marks a distinctly new departure in naval engineering. Hitherto all the ferry boats in these waters have been driven by side wheels. These lend themselves very perfectly to double-ender propulsion, it being practically immaterial as regards the perfection of their action whether they drive the boat in one direction or the other.

In the new boat the motive power of the screw has been adopted, and has been applied to the same type of vessel. A shaft is carried the entire length of the hull, emerging at each end. To each of the ends a screw, both of identical pitch and diameter, is secured. In advance of each screw a rudder is placed, provided with the usual pin for holding it fixed when made to constitute the bow end of the boat. As seen from the outside, each end of the vessel appears precisely like the stern of an ordinary propeller.

A single engine is provided to drive the screws. Both, therefore, have to rotate together and at exactly the same speed. They propel the boat by the pulling action of the leading wheel and the pushing action of the rear one.

By their use several important results are achieved. The most obvious ones relate to the increased deck room. Her engines will be entirely under deck, a space of two feet intervening between their highest parts and the deck planks. The smoke stack is to be elliptical in section, to save width. On account of these features of construction, the central deck house will be two feet narrower than the usual ones and about two-thirds of their length. The cabins will be unobstructed by the paddle boxes. The narrow gangway leading fore and aft will be disposed of, and the area will be clear of encumbrance from front to rear. These changes, it is calculated, will give an increase of capacity of twenty per cent for trucks and carriages and thirty-five per cent for passengers.

It has been found by experience that a tug boat can cope quite effectually with the ice that packs in the ferry slips, and one has often been used for the purpose of clearing them of ice. The new boat will, it is anticipated, prove most effectual in this regard. Paddle wheels can only drive ice about twenty feet, but screws are far more effectual. As the new vessel enters a slip, her forward screw will start currents of water that will carry the ice past her sides, to be driven out into the river by her after screw.

This is not the first boat of her class, if the term is broadly interpreted. A single-ended boat, with bow and stern screw, has been recently put in use at Detroit. It works, however, on a different principle from that of the new ferry boat. The Detroit vessel's after wheel is larger than the forward wheel, and each is driven by independent engines. Normally both are turned in the same direction. When ice is encountered the forward wheel is reversed, and the vessel is propelled by the differential action of the larger and small wheels. The smaller forward wheel forces currents of water out from the bow that clear the ice so effectually that the boat can go steadily through a field of considerable thickness. Double-screwed boats, with independent engines for forward and after screws, have also been used on the Mississippi. These were not double-enders. They were found to injure the levees, and were finally discarded from regular service, and were used to clear the channels in the carrying out of Col. Eads' successful project.

Thus the new vessel is of distinct type. As seen on the ways, her model was characterized by fine lines, her ends being very sharp, giving good entrance and run. She is two hundred feet long, sixty-two feet over the guards, thirty-two feet width of hull, seventeen feet deep, and will draw from nine and a half to ten feet of water. She is of steel throughout. She is to have two tubular boilers, eight feet diameter by twenty-three feet long, to work at 160 lb. pressure. Her engine is of twenty-four inch stroke, triple expansion, with eighteen and one-half, twenty-seven, and forty-two inch cylinders. The shaft varies from 8¼ to 8¾ inches. The screws are of eight feet diameter and nine and one quarter feet pitch. They are alike on both faces, so as to cut both ways with equal efficiency. She was christened the Bergen.

Col. E. A. Stevens and Capt. C. W. Woolsey, of the Hoboken Land and Improvement Company, were the originators of the idea, and anticipate a better winter service from the Bergen than any vessel now afloat can render. Our thanks are due to them for their courtesy in giving us all the information attainable about their new and yet unfinished vessel.

**A Saratoga Spring over 3,000 Feet Deep.**

A dispatch from Saratoga says: A company has purchased the Seltzer Spring and will utilize its waters for the purpose of liberating and storing, in liquid form, the carbonic acid gas with which it abounds. To do this, extensive arrangements are being made upon a large amount of invested capital. The establishing of the plant is under the supervision of Mr. Oscar Brunler, a German expert.

This Seltzer Spring, located on Spring Avenue, was developed by Dr. Haskins less than three years ago. The drill was put down to the depth of 500 feet. At this depth an abundant supply of water was found flowing from a crevice in the rock bottom. A few days ago, to assure himself of the depth of the spring, Mr. Brunler sounded it with a line and plummet; but instead of resting at 500, the weight sank the whole length of the line, 900 feet. Other soundings have since been made, the weight used being a piece of inch gas pipe filled with lead and weighing thirty-four pounds, until a depth of 3,300 feet has been reached, and yet without touching bottom or any obstacle. No further soundings will be made until instruments expressely designed for the purpose can be procured.

Prof. Brunler admits it as possible that the line and weight could have been carried away by some powerful current, but he holds to his original belief in the existence of a subterranean sea of greater or less extent, and that there is undoubtedly some connection between it and the water of the ocean. In other words, that Saratoga is over a vast water-filled cavern, the roof of which is about 500 feet thick. He also thinks it probable that at a given depth and temperature carbonic acid gas may be found in a liquid form. The specific gravity of the liquid gas is about nine degrees lighter than water, which would readily cause the water to climb 300 feet above the ocean level. Should the existence of a subterranean sea be established, it would put to flight many theories and scientific speculations as to the source and course of the many mineral springs here.

**Causes of Fire.**

In regard to spontaneous combustion, the fires of the year in Boston have furnished some new observations of considerable importance. In one case, says the *American Architect*, a quantity of feather dust in a bedding manufactory took fire without apparent reason. It was found, however, that a piece of thick glass had been lying on the feathers, and the sun's rays, concentrated in some way by the glass, had set fire to them, although the day was a cold one in the month of March. In another case, a number of tarpaulin hats were lying, packed together, in a window. The high temperature, with, perhaps, the close packing of the hats, caused them to burst into a blaze. Two other fires were caused by putting paraffine paper, such as candy is wrapped in, into a refuse barrel which contained a little sawdust; and a third, which destroyed twenty thousand dollars' worth of property, was occasioned by putting greasy paper, which had been used to wrap lunches in, into a wooden refuse barrel, which contained some sawdust and sweepings.

### Premiums or Gifts with Sales.

G. was convicted of selling food and giving away, as part of the transaction, a premium, in violation of the statute (Sec. 335 *a*, New York Penal Code) which provides a penalty against "any person who shall sell, exchange, or dispose of any article of food, or offer or attempt to do so, upon any representation, advertisement, notice, or inducement that anything other than what is specifically stated to be the subject of the sale or exchange is or is to be delivered or received, or in any way connected with or a part of the transaction, as a gift, prize, premium, or reward to the purchaser." In this case—People *vs.* Gillson—on appeal, the Court of Appeals of New York reversed the judgment, Judge Peckham, in the opinion, said:

"Here the offense, as set out in the warrant, was the delivery of a tea cup and saucer by the Great Atlantic and Pacific Tea Company to one A., on a purchase by him of two pounds of coffee from it, the company having announced or advertised that such a gift would be made to a purchaser of two pounds of coffee. The defendant contends that the statute is void, as it interferes with his 'liberty' as secured to him by the constitution. 'Liberty,' in its broad sense, as understood in this country, means the right not only of freedom from servitude, imprisonment, or restraint, but the right of one to use his faculties in all lawful ways, to live and work where he will, to earn his livelihood in any lawful calling, and to pursue any lawful trade or avocation. It is quite clear that some or all of these fundamental and valuable rights are invaded, weakened, limited, or destroyed by the legislation under consideration. It is, evidently, of that kind which has been so frequent of late—a kind which is meant to protect some class in the community against the fair, free, and full competition of some other class, the members of the former class thinking it impossible to hold their own against such competition, and, therefore, flying to to the legislature to secure some enactment which shall operate favorably to them, or unfavorably to their competitors, in the commercial, agricultural, manufacturing, or producing fields.

"By the provisions of this act a man owning articles of food which he wishes to sell or dispose of is limited in his powers of sale and disposition. It is lawful to sell coffee, and the defendant here may be satisfied to take a less profit upon a single sale by making the gift, because he can thereby increase his sales and have a greater income by reason of a greater business at the end of the year. This statute, if valid, steps in to prevent his adopting such a course to procure trade, and from it to secure an income and livelihood for himself and his family. It is contended here that the statute should be upheld on the ground that its enactment is a proper exercise of the police power of the State:

"1. Because the transaction is in the nature of a lottery, indeed, the statute is placed in the penal code under the head of 'lotteries.' 2. That the sale of impure, unwholesome, and adulterated food is thereby hindered. We are of opinion, however, that the words of the statute cannot be construed to have been intended to defeat a lottery or to declare that the sale of bad food would thereby be interfered with. The conviction must be reversed, and the defendant discharged. All of my associates concur in this judgment."

### Completion of Another Line of Railway between the United States and the City of Mexico.

At 5:45 P.M., on Saturday, September 29, the last spike was driven on the main line of the Mexican National Railway, thus completing the line of track, 825 miles, between this city and Laredo, Texas. It is stated that, in less than a year, 800 kilometers of line have been built. Much of course remains to be done to prepare the line for regular traffic, but it is believed that the road will be open for business between the 15th of the present month and the 1st of November next. The completion of the road, which was formerly generally known as the "Palmer-Sullivan" line, has been delayed four years after the completion of its rival, the Central, owing to financial troubles. The work of the present year has been to build the missing part of the main line, 352 miles, between Saltillo and San Miguel de Allende, in the State of Guanajuato. Under a reorganization of the company, English capital was brought into the enterprise, and an effort made to get the road, so far as possible, under control of the English party in the company. There has been a general rearrangement of the official staff, and the English party keep a close eye on the finances of the company. The present company took possession in July, 1887, and work began on the main line at the northern end in October, and on the southern end in December. Since that time construction has gone on actively, subject to inspection on the part of engineers appointed to oversee the work in the interest of the English bondholders; and a special report on the construction work has been prepared by Mr. Robert Moore, vice-president of the American Society of Civil Engineers, which has created some controversy, owing to its severe criticism of methods, etc.

The new line going south from Laredo crosses the northeast corner of the State of Coahuila, the western part of Nuevo Leon, the southeast corner of Coahuila, the center of San Luis Potosi, the center of Guanajuato, the northeast corner of Michoacan, and the northern part of the State of Mexico. The ascent from the Rio Grande to the table land occurs principally between Monterey and Saltillo, the latter place having an elevation of 5,240 and San Luis Potosi of 6,090 feet.

By an unfortunate accident, the train coming down from San Luis Potosi recently, bringing a party who had witnessed the driving of the last spike, was thrown from the track at Zirizicuaro in the State of Michoacan, but, luckily, no person was injured, with the exception of a brakeman.

The connection of San Luis Potosi and Monterey with this capital by rail, and the opening of mining regions formerly inaccessible, like the Catorce district, is certain to have an important effect on the commerce of the country. It is understood that the management intends to make especial efforts to secure a large share of the tourist traffic the coming winter and spring, and there is talk of a reduction in rates between the United States and this city, *via* this line.—*Mexican Financier.*

### Small Caliber Projectiles.

The *Horse Guards Gazette* says: "At 1,070 yards the percentage of hits was very much in favor of the rifles, and something more than an accident to the gun's training gear is necessary to account for the small number of hits recorded for it. An explanation will, probably, be found in the fact that correction of range is a much more difficult operation in the case of artillery—and a machine gun must for scientific purposes be so classed—than for infantry. It requires long training of a special kind, in which only artillery officers are at present proficient, and the gun in this case was manipulated by an infantry lieutenant. Whatever may have been the cause of comparative inaccuracy at the first stage was speedily corrected afterward, until at the extreme distance there was a difference of 63·60, as against 43·88 per cent of hits in favor of the gun. At this range, however, only 250 rounds were got off from the mitrailleur, while the rifles fired 335, so that either rapidity would seem to have been sacrificed for the sake of accuracy or smoke must have hung longer in front of the gunner than it did before the riflemen. As to the necessity for special training on the part of any person who handles the Maxim gun, there is emphatic evidence in the report furnished by Major Mecham, the District Inspector of Musketry, who also lays stress on the importance of a smokeless powder for such weapons. Especially in the defense of positions he adds valuable testimony; but, on the other hand, he apparently agrees with a view often expressed by us that no kind of machine gun can ever supersede or even lessen the utility of infantry fire. It is a splendid auxiliary weapon, but nothing more, and the sooner we adopt a system of tactics based on that supposition the better.

"The most conclusive evidence against rifles of small caliber is furnished by an officer who watched the effect produced at the butts. Lieutenant Addington reports that at 1,900 yards the bullets from the rifle fell with little energy as compared with those from the gun (M. H. ammunition). Many of the bullets picked up were almost perfect in shape. The wind carried whole volleys clear of the position. This is a very serious objection, and one that seems to have been quite overlooked by advocates of the small bore. The force of gravity tells when that of powder is beginning to be exhausted, and the energy with which a bullet falls is its own weight multiplied by the square of the distance, and plus what remains of the initial velocity. This weight of metal must be of great importance at long ranges, and for machine guns, therefore, light projectiles would be obviously undesirable; but difference of ammunition is a still more serious drawback, and in view of this fact tacticians will probably hold that we have been somewhat premature in yielding so readily to the craze for small caliber."

### Meteorological Notes.

The Canadian *Weather Review* records a fall of 2·02 inches of rain in 2½ hours at Richmond, Province of Quebec, on June 14. It is the heaviest rainfall ever recorded there. The 6th of June was a day of many thunderstorms. At Minden large pieces of ice fell, stripping forest trees.

The United States *Monthly Weather Review* publishes monthly now a list of heavy rainfalls within its territory for the month. It is of very great interest, and we hope to have something farther to say about it when the year is completed.

The same journal contains monthly much valuable matter in the form of long time records of meteorological elements. For instance, the issue for May gives the annual mean temperatures at Philadelphia for 110 years, and the coldest days at Thompson, Conn., for 100 years.

*Apropos* of a change of climate in the West, we take the following extract from J. B. Harrison's "The Latest Studies on Indian Reservations." Mr. Harrison says: "It is evident that in all that region the earlier unfavorable estimates of the agricultural capabilities of the Indian country have been considerably modified. The tendency now is toward extremely sanguine judgments and expectations. The white people say that the rainfall has increased to a surprising extent, and they are confident that during the next few years it will increase in still greater proportions."

The newspaper reporters often use glowing language concerning the great phenomena of meteorology, such as tornadoes, blizzards, and thunderstorms; but the following is the first of the sort which we have seen in which the thermometer is misused. We clip it from the Downington *Review*, as we have not the pleasure of exchanging with the paper in question: "The advent of summer in the South is described by an editor in appropriately glowing language: 'The mercury, like a cringing sycophant, quick to do homage to the coming queen, bounded up toward the nineties, and the glowing sunshine showered upon the woods and fields and sweltering mortals like wavering sprays of molten gold.'"

One of the interesting features of the approaching French exhibition is to be a model of the earth, made on the scale of one-millionth. It is to be accurately constructed, and will rotate on its axis. Even on this scale it will be an enormous object, nearly 21 feet in diameter.

Major Powell, head of the National Geological Survey, lays down the proposition that "the cutting power of a stream increases rapidly with the increase of sedimentary load." It is a text from which many sermons might be preached, and Major Powell has preached one in applying the principle to the control of the lower Mississippi River.

The activity of Lieutenant Finley must be very great, and is effective in results. We have on our table a new publication on tornadoes by him, which we will notice more fully at another time. And now we are in receipt of a circular advising the public of the publication of a set of 15 storm track charts for the North Atlantic Ocean. A resolution before the House of Representatives recommends their publication for public distribution.

Important publications for seismologists are the two lists of earthquakes in Mexico and California. The former runs through several numbers of the *Memorias de la Sociedad cientifica "Antonio Alzate,"* of Mexico, and is edited by Don Juan Orozco y Berra. It begins with Aztec records in 1460, and includes many hundred earthquakes, in some cases in much detail. It ends at the current year. The difficulties of deciphering the Aztec records are unknown to us, but we have noticed in the year 1507, when an earthquake is said to have accompanied an eclipse of the sun, no such eclipse could have been visible in Mexico. The nearest one we can find is in 1496. The California list is by Dr. Holden, director of the Lick Observatory. The territory covered includes also Lower California, Oregon, and Washington Territory, and the list is published by the State. This list begins in 1769. It includes many hundreds of earthquakes, of which, however, only twenty-four have been serious since 1800. Dr. Holden makes some interesting studies of their relations to the seasons, etc. It seems that earthquake records make part of the regular work of the Lick Observatory.—*American Meteorological Journal.*

### A Barrel of Flour Made into Bread.

The *American Analyst* thus sums a baker's profits, or what a barrel of flour is worth when made into bread. A baker will toss a barrel of flour into a trough. Then he tosses 104 pounds of water on top. A quantity of yeast is added, and then the jolly baker has 300 pounds of dough to operate on. The 300 pounds cost him $5. In short order the dough is turned into "twists," high loaves, pan loaves, and other styles of the same quality. The oven's heat reduces the 300 pounds of dough to 260 pounds of bread. The baker sells his bread at the rate of four cents a pound, or at an advance of over 30 per cent over what it cost him. There are 1,400 bakers, great and small, in this city, and to them is committed the trust of supplying bread for 1,300,000 persons. There are many bakers in this city who make 1,300 loaves of bread per day and sell it for from $80 to $150, or at a net profit of $40. Little money is lost in the business, and most bakers do a cash trade. It is very seldom that bakers fail. The business is steady, reliable, and attended by a very few risks, unless incompetent workmen.

### A Toad in Solid Coal.

The correspondent of the *Colliery Guardian* reports a case which, if true, must be interesting to geologists. In the Coleford district of the Forest of Dean a small colliery has recently been opened, and while a collier was engaged in breaking up a fall of block coal, he found a toad in the center. It seemed firmly embedded in the coal, and it was alive. Its form was imprinted upon the face of the mineral, and the animal is still living. The incident has occasioned much interest in the neighborhood.

## THE MACKEY AUTOMATIC FIRE EXTINGUISHER.

The use of automatic sprinklers to prevent damage by fire, in factories and manufacturing establishments generally, began to command general favor only about ten years ago, but the amount of property probably saved from destruction by their use is already figured by one insurance company (the Boston Manufacturers' Mutual) at several millions of dollars. The proved advantages of the sprinkler system have been so decided that no one who has hazardous property to protect can afford to neglect an examination of it. An illustration of such a system, operated in connection with an electric thermostat and fire alarm, and which may be used as either a wet or dry pipe system, is shown herewith, embodying the improvements of The J. C. Mackey Company, of Syracuse, N. Y. In the dry pipe system, as is obvious, there is no freezing of water in the pipes, and the whole arrangement is entirely simple.

The system consists of pipes running along the ceiling of each story of a building, at suitable distances from each other, into which are screwed the automatic sprinklers or heads, at such points and distances apart as required under the rules of the different insurance underwriters' associations of the various States. These heads are so constructed that, in discharging water under pressure, they will throw the water up against the ceiling as well as over anything in the immediate locality on the floor below, covering with each sprinkler a space of from 25 to 40 feet in diameter, according to water pressure. Each head is fitted with a device held in place by a fusible solder, the solder melting at 155° F. When the temperature in a room in the vicinity of one of these heads passes this point (or a still higher point may be fixed if desired), the melting of the solder opens the valve, and the sprinkler throws the water.

Our illustration shows the system operated by a thermostat electrically connected, the overhead pipes not being filled with water. The thermostat is connected by suitable conductors with a battery, an alarm bell, and a magnet, whose armature is adapted to release a small weighted lever, arranged to open a valve in the water supply pipe, the position of the levers when the valve is opened being shown in dotted lines. The water supply may be connected, as most convenient, with a tank or reservoir on the roof of the building, with a city main, or with a force pump: or, if all these sources of supply are in communication with the system, a special form of valve is employed, by which the supply will be taken only from the source giving the greatest pressure. Only one thermostat is shown in our illustration, as explaining the principle of the system, but in practice there are generally as many of these as there are sprinklers, each thermostat having a soldered piece of metal, the fusing of the solder allowing the piece of metal to drop off and a plunger to fall, which makes a continuous circuit to the magnet operating the valve by which the water is let into the pipes. By suitable connections, alarms are also given at any desired points outside the building. Any one can turn off the water if desired, to prevent unnecessary damage from such cause after fire has been extinguished.

This system of protection against fire has received high commendation from users, who testify, in many cases, to having saved valuable properties by its prompt and efficient operation. The saving in insurance alone is said to more than pay all the expense of equipping any building in from one to five years, rates being reduced from 25 to 75 per cent in different instances. The company will make surveys of buildings and furnish estimates of cost of putting in the sprinklers complete, or furnish any further information which may be desired relative thereto.

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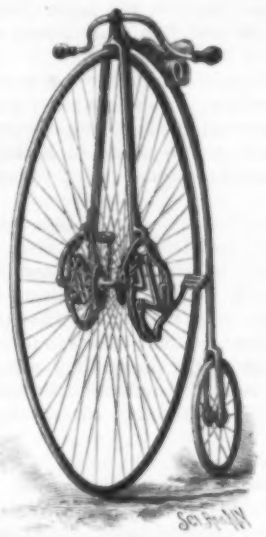
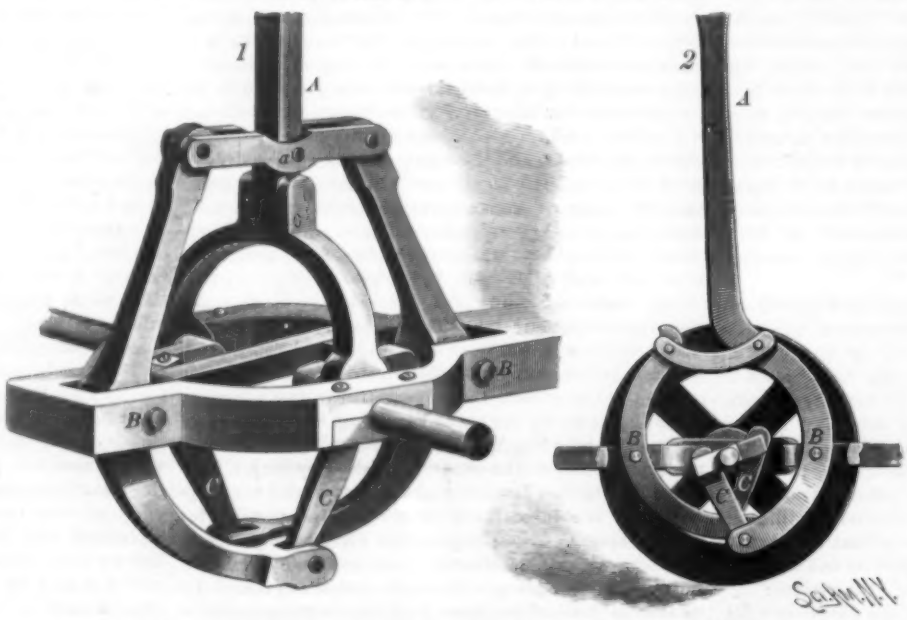
GRAINING is so far out of style in St. Louis that there are no highly paid grainers in any of the shops, and a grainer is very willing to fill in his unemployed time at plain journeyman's work and wages. The city is growing out of the era of imitations into that of real wood and real workmen.

## AN IMPROVED MECHANICAL MOVEMENT.

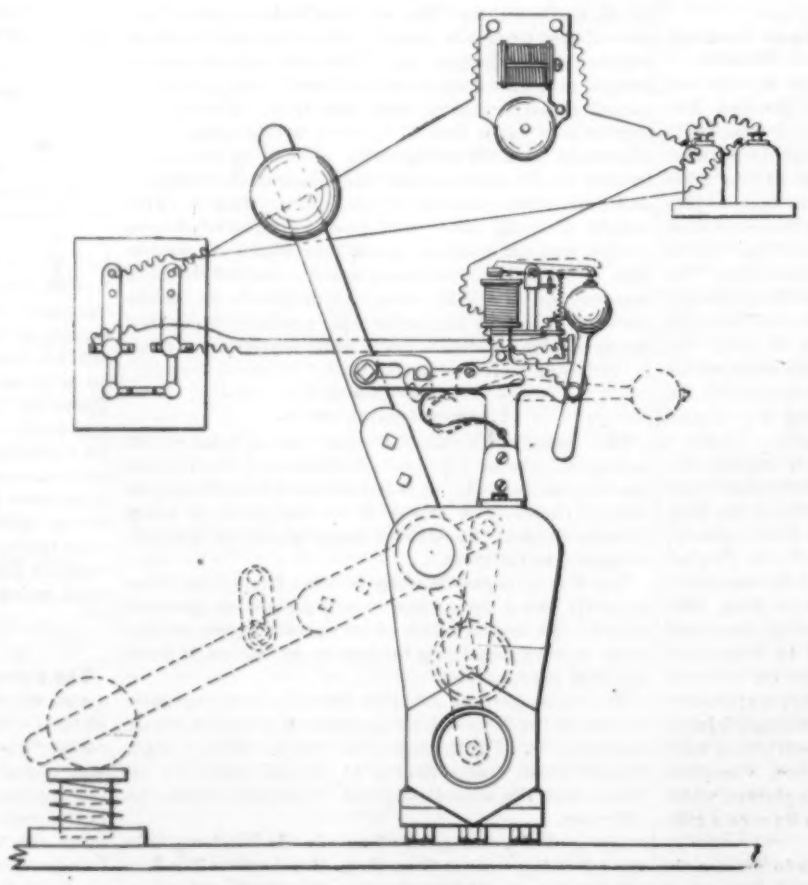
A compound rotary motion device which, with one vibrating lever, directs a continuous double application of power to the cranks, causing a complete revolution with but a short swing of the lever, is illustrated herewith, and has been patened by Mr. James F. Hanley, of No. 15 State Street, New York City. The shaft has two cranks set diametrically opposite each other in a yoke-shaped frame, the journals of the shaft passing through circular hubs or bosses on both inner sides of the frame, and upon these hubs or bosses are hung the forked ends of a hand lever, A. This lever is connected by a fulcrum pin at *a* to the middle of a pair of link bars, which at their outer ends are jointed to the ends of two levers pivoted in the yoke-shaped frame at B B, on opposite sides of the crank shaft. These levers, at their outer ends, curve partly around the shaft, and are separately connected by pitman rods, C C, to the two cranks of the crank shaft. When the hand lever, A, is oscillated, its forked ends turn on the hubs or bosses in the yoke-shaped frame, and, through the link bars, to which it is pivoted at *a*, it transmits motion to the two curved levers, which causes the pitman rods, C C, to act on the oppositely set cranks of the crank shaft, one pitman pulling in one direction while the other is pushing in the opposite direction, thus giving a continuous rotary motion. A modification of this invention is shown in Fig. 2, in which the hand lever, A, is formed in one piece with one of the semicircular levers, which are fulcrumed at B B, and connected at their outer ends with the two pitman rods, C C, the principle of the device being unchanged. In another illustration this compound rotary motion device is shown as applied to a bicycle. When two levers are to be used, the dead center is readily overcome without any change of the position of the crank, and the device will work equally well in making either backward or forward motion, its parts being evenly balanced and compactly arranged to facilitate its ready application.



HANLEY'S CRANK APPLIED TO A BICYCLE.




HANLEY'S COMPOUND DOUBLE CRANK ROTARY MOTION DEVICE.



THE MACKEY ELECTRIC THERMOSTAT AND AUTOMATIC FIRE EXTINGUISHER.

### Dynamo Telegraphy.

Although, as was recently pointed out by Prof. S. P. Thompson, the early telegraphs of Gauss, Weber, Steinheil, and others were operated by means of magneto-electric apparatus, it is only of late years that dynamo-electric machines have been regularly employed for the purpose of generating current on telegraph circuits. Perhaps the most notable instances at the present time are the plants in this city at the headquarters of the Western Union and Postal Telegraph companies, both of which have been described in our columns during the present year. In this issue, however, we call attention to another plant of the same character, and one which embraces several features of novelty. Not only are the circuits supplied with current from these dynamos, but the dynamos themselves are driven by electric motors, which, in turn, are operated from the motor circuits of the local electric light company. Another feature is that the current is used on a large scale for the "local" circuits, and, as Mr. Maver has said in his article, this is the first time that dynamos have been used to replace "local" batteries. The plant has been installed under the supervision of Mr. S. A. Duncan, who, as an old telegrapher, as well as a leading electric light engineer of the modern school, is thoroughly familiar with all the difficulties of the problem, and who, in co-operation with Mr. Gerritt Smith and others, appears to have made a distinct and brilliant success of the experiment.

The number of cells displaced in Pittsburg by the main line machine is placed at about 12,000, and by the local machine at about 1,100, and the office at Pittsburg is probably the first in the world at which there is no chemical cell or battery employed. It is noteworthy that all the other machinery in the office is driven by dynamo current, and that, as the article mentions, in the telephone office in the same city the generators for the telephone company are also driven by motor. If our electric light readers cannot see a very direct "pointer" in this plant, as to the manner in which they also can supply current from their stations for telegraph purposes, we are afraid that they are not quite abreast of the times or equal to their opportunities. We think, however, that many of them will be doing considerable work in this field at no very distant date.—*Electrical World.*

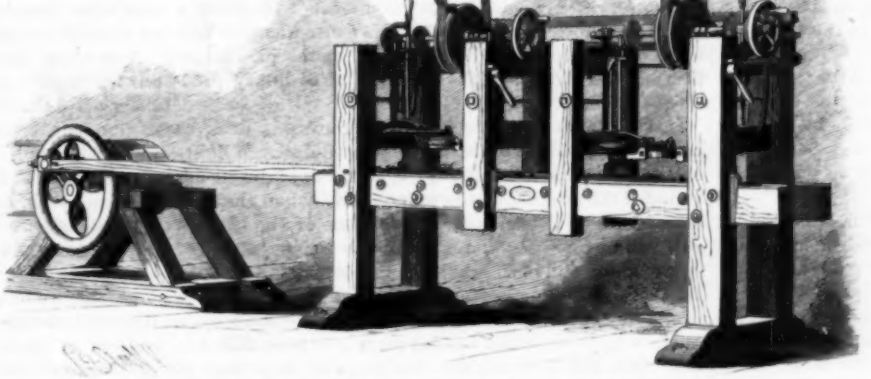
### Conduit for Electric Wires.

A Pittsburg man has invented a glass conduit which looks as if it might answer the purpose, and which the inventor is sure solves the problem of underground electric wires. Plates of glass are grooved on the upper surface, and the wires are laid in the groov and cemented there with pitch. Th other plates of glass are laid over the first, and wires put upon them in the same way. When all the wires are laid, the whole is inclosed in a wooden box and embedded in cement.

### A NEW MACHINE FOR MAKING EXCELSIOR.

An improved machine for making excelsior, or the curled shreds of wood used as a substitute for curled hair in mattresses, and for stuffing cushions, packing furniture, etc., has recently been perfected by the S. C. Forsaith Machine Company, of Manchester, N. H., and is shown in the accompanying illustration. The machines built by this company are in use in various parts of the country, and have an excellent record as being strongly built, without superfluous material, while being very economical machines to use, as attested by a long list of testimonials. The frame of the machine shown in the cut is of Georgia pine, 7 inches square, and is 6 feet long, 4 feet 11 inches high, and 2 feet 7 inches wide. It is a double machine, cutting two blocks at one time. There is one set of knives and spurs in each crosshead or slide, so arranged that one set of knives and spurs operate on one block when going one way and the other set on the opposite block when returning. The blocks may be 12 to 20 inches long, 2 to 6 inches thick, and any width up to 14 inches. The knife plates are steel plated, and the slides are adjustable to take up the wear. The feed screws are of Norway iron, and the boxes are of iron, babbitted. The knives are set at an angle, so as to curl the excelsior as it comes off. The holding heads or dogs are so arranged that when the block is used up as far as possible, the feed is thrown out automatically, while by moving a shipper the head is run back by power to take a new block, such block being put in without interfering with the other head, which will be feeding all the time, and can be supplied with a new block in the same way, the two heads on the machine being worked independently.

With the machine is furnished a countershaft with tight and loose pulleys, and a balance wheel with wrist pin adjustable to different lengths of stroke, counterbalanced so that it can be run at great speed. The connecting rod is made of hard wood, with heavy straps, bolts, and brass boxes, being light and strong. The machine is designed to run about 200 revolutions a minute, at which rate it will cut 1,000 to 1,200 pounds of excelsior per day of ten hours, though in some cases, with skilled operators and nice stock, they have produced 1,500 to 1,600 pounds per day; while by placing two machines facing each other, to be attended to by one man, considerable saving in labor may be effected. The excelsior made on these machines frequently commands a higher price in market, from $2 to $3 per ton, over that made on upright and other machines, it being so nicely curled. A cord of wood should make from 1,800 to 2,000 pounds of excelsior, according to the quality and condition of the wood. It is calculated that the waste wood is sufficient to furnish power if steam is used. The woods considered best for the manufacture of excelsior are the following, ranking in the order named: Poplar, white birch, yellow birch, bass, whitewood, and soft maple.

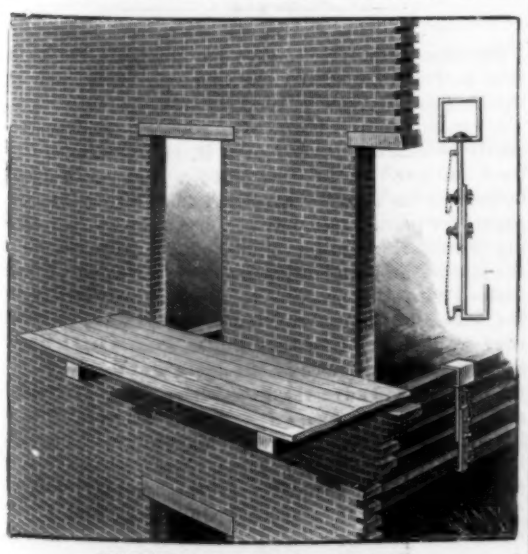


THE FORSAITH IMPROVED MACHINE FOR MAKING EXCELSIOR.

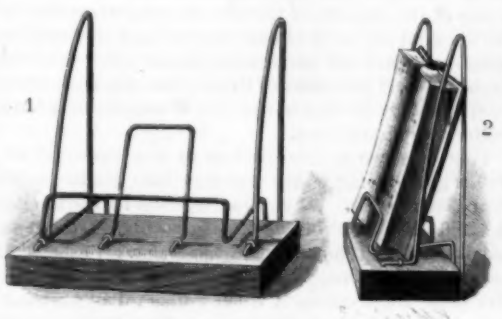
The Forsaith Machine Company also manufacture a general line of woodworking machinery, and furnish anything in the line of steam power or machine shop equipment.

### AN IMPROVED SCAFFOLD HOLDER.

A simple and easily adjusted device adapted for use in supporting scaffolds on the outside of buildings is illustrated herewith, and has been patented by Mr. William J. Blundell, of No. 152 East 129th Street, New York City. The holder is made with a skeleton frame at its upper end, adapted to slip over the inner end of a beam which may be projected from a window to support a scaffold, while its lower end has a hook to engage with a joist of the flooring, as shown in the sectional view, so that the holder serves as a tie rod between the beam and joist. The holder is made in two sections, which overlap each other and are held in place by pins passing through corresponding holes, whereby the holder may be adjusted as to length according to the distance from the top of the window sill to the lower edge of the joist.



BLUNDELL'S SCAFFOLD HOLDER.




HARBAUGH'S BOOK HOLDER.

### AN IMPROVED BOOK HOLDER.

A simple and inexpensive device for holding books in an open position, at a suitable inclination for reading, is illustrated herewith, and has been patented by Mr. Frank P. Harbaugh, of Chambersburg, Pa. Near the ends of the base piece are wire standards, bent into an approximately V shape, and midway between the standards is secured a bent wire support for the back of the book. Between the standards and the support are arranged the arms of the bottom support, so that the leaves of a book placed on the arms may be held in open position by the horizontal part of the support, the covers resting against the standards, and the book being thus held in a light spring clamp. This holder may be attached, by simple fixtures, to chairs, lounges, etc.

### American Industries and the Brussels Exhibition.

The following extract from a note to the *Evening Post*, just received from one of the jurors of the Brussels exhibition, shows that though the number of American exhibitors was not large, the reputation of American artisans for ingenuity and talent was fully sustained by those who represented them. The writer, under date of the 5th of October, says: "I have just finished the duties of juror at the exhibition, and must let you hear of the returns. In the agricultural machines, on which division I was put, we got for the United States three diplomas of honor—the highest award—and one gold medal; in other words, a diploma of honor for each exhibitor but one, and he really only deserved the gold medal. The other exhibitors fared equally well, for out of 73 *exposants*, 54 got distinctions of greater or less degree. I think we have reason to congratulate ourselves."

THE Smithsonian Institution, at Washington, has sent an expedition to Nova Scotia and secured facsimiles of the "fairy rocks," on which are curious hieroglyphic characters, evidently very old, which may throw some light on the history of the early discoveries of America. The markings are cut in upon a rock of highly polished slate, and the intaglio is about a sixteenth of an inch deep.

### Long Distance Telephoning.

Words spoken in Philadelphia can now be heard in Portland, Me., a distance of 450 miles. A member of the *Review's* staff in New York conversed with Mr. Standford, manager of the telephone exchange at Portland, Me., on October 6, and heard every word distinctly. The American Telephone and Telegraph Company, of New York, of which President Theo. N. Vail and Vice-President and General Manager Ed. J. Hall, Jr., are the energetic and far-seeing executives, is to be congratulated on the successful opening up to telephone service of this vast and wealthy territory. What was at first looked upon as a doubtful venture is now rapidly becoming recognized as one of the successful and progressive moves in recent electrical history. The large and important cities of Philadelphia, New York, Brooklyn, Albany, New Haven, Hartford, Providence, Boston, and Portland, with intermediate towns, are now in telephonic communication, covering a territory represented by seven States. By November 1 this company's lines between Buffalo and Albany will be completed, and the cities of Syracuse, Rochester, Utica, Auburn, etc., will enter the long distance telephonic system.

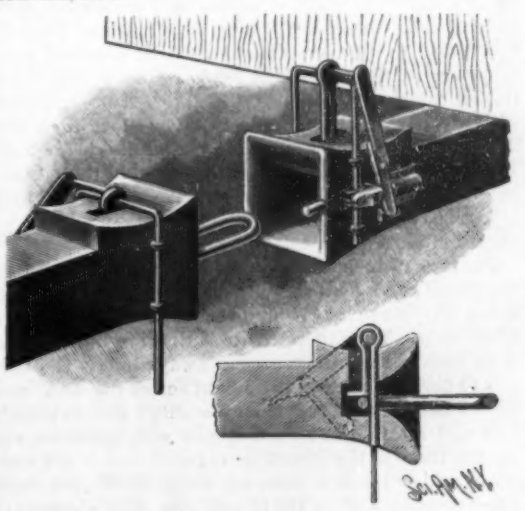
There are at the present time over 100 manufacturing establishments in the territory adjacent to New York that are daily patrons of this system, either by leasing lines or by contracting for so many hours per day, and these companies are all supplied with the improved long distance transmitter—the invention which, with the use of hard-drawn copper conductors, made possible this wonderful and potent advance in the telephonic industry.

The extension of this system to Cleveland, Pittsburg, Baltimore, Washington, Cincinnati, and Chicago is now only a question of time. It is known to be electrically possible, and the experience of the American Company so far leads to the belief that it will be successful from the stern standpoint of dollars and cents.—*Elect. Review.*

### AN IMPROVED CAR COUPLING.

A car coupling which is simple and durable in construction and automatic in operation is illustrated herewith, and has been patented by Mr. Joseph H. Weaver, of Grange, Ga. The coupling pin has a rearwardly extending foot or arm adapted to rest on the inner end of the coupling link, to hold the latter in horizontal position, the coupling pin being held to slide vertically, and its upper outer end being supported by a U-shaped frame, having its side arms engaged by eyes secured to the sides of the drawhead, whereby the frame is perfectly guided in its up and down movement. From one side of this frame projects a pin on which is fulcrumed an arm pivotally connected to a second arm pivoted at its lower end to one side of the drawhead, the latter arm having a pin adapted to engage the lower end of the upper arm. The front edge of the lower arm is also adapted to be engaged by a dog pivoted to a bar sliding horizontally on the side and projecting beyond the front of the drawhead. With the coupling in the position shown in the left-hand figure, the link being held horizontally by the foot of the coupling pin resting upon it, the coming together of the opposing drawheads causes the dropping of the coupling pin held in the drawhead to the right, the pushing in of the horizontal bar causing the pivoted arms at the side to assume the position shown in the small sectional view.

For further information relative to this invention address the patentee, or Mr. S. W. Hamilton, Hendersonville, N. C.



WEAVER'S CAR COUPLING.

### Risk in Firing Big Guns.

The blast of the discharge and the concussion produced by the modern high-powered rifle gun has introduced a new element that must be considered in designing ships to carry guns of heavy caliber. Until recent years the charge of powder usually weighed from one-sixth to one-tenth the shot, whereas in the new built-up steel guns the charge has been increased to one-half the weight of the projectile. The 110 ton guns of the British battle ship Benbow fire a shot weighing 1,800 pounds with a charge of 1,000 pounds of powder, and the 189 ton Krupp gun now building, and designed to pierce 47 inches of wrought iron, will have a still heavier charge.

The experience on board the Atlanta and Boston, with the 6 inch guns firing a charge of only 50 pounds, demonstrated the importance of this question, and proved that if guns are placed in echelon the crew of the foremost must be protected from the blast of the one in the rear. In these ships, owing to the comparatively small charge, there is no doubt expressed by the officers as to the possibility of interposing a movable shield or a heavy curtain that may afford sufficient protection for the guns' crews. Further experiment will solve the problem.

Some of the boats of these vessels hoisted at davits projecting from the side were shattered or had their seams opened by the force of the concussion. This fact must be carefully noted in the other ships now building to prevent a like result. The Chicago, for instance, can never fire her 8 inch guns astern without carrying away the boats that will be hoisted at the old-fashioned davits now provided for that purpose. The necessity for protecting the boats would not exist in actual battle, since their destruction will be rendered certain by the fire of the enemy's guns—particularly by the machine gun fire, which, to secure penetration, will be directed against the upper works, and the boats will be riddled by the hail of small shot. But during target practice, in time of peace, it is desirable to save a ship's boats, since the expense of repairing and replacing them at every practice would be considerable, and they are necessary to the safety of the crew in case of accidental collision or shipwreck. It has always been the custom in men-of-war to carry a number of boats at projecting davits clear of the ship's side for convenience in lowering, but this plan has been abandoned in the most recent ships, and we now find the boats stowed, as in mail steamers, on supports or cradles over the upper decks. Such will be the only solution of the question in the ships now building, and with the exception of the Roach cruisers, which were designed before this point had been discovered, all boats will be stowed inboard.

Wooden boats are so easily shattered or damaged by the vibration that it may be well to consider the advisability of constructing a man-of-war's boats of thin steel or iron plates.

As to the effect of concussion upon the hulls and fittings of vessels of war, gun trials and experiments tend to show that this question is also one that must be seriously studied. Commander William M. Folger, of the navy, anticipating this question of the blast of modern guns, made an experiment at the Naval Ordnance Proving Ground, at Annapolis, the result of which is most instructive. In order to secure end-on fire, which is an important feature in ships designed for ramming, chasing, or running away, some of the guns, and usually the heaviest ones, are mounted in projecting sponsons or in turrets on the upper deck, in which case the muzzles of such guns may be very near the ship's side, or the superstructures, when fired in line with the keel. To ascertain the probable effect of the discharge, Commander Folger built up and suitably braced a structure of iron plates representing the side of an unarmored ship, or one of her superstructures, and then fired a modern gun parallel to the plates, the muzzle being at the lateral distance likely to exist in practice. The result of the blast was to bulge in the plates and set the whole structure back somewhat, notwithstanding the security with which it was braced. The lesson of this experiment received practical confirmation in the trial of the 100 ton guns on board the Italian battle ship Lepanto, which, when fired in line with the keel, produced a destructive effect upon the ship's superstructures which took weeks to repair. These facts should be intelligently noted in their bearing upon the ironclads Maine and Texas, now building in our navy yards, since to ignore them may lead to needless disaster.

The four 10 inch guns of the Maine are designed to fire ahead and astern as well as on both sides across the decks, the two turrets being in echelon, one on each side of the ship. The superstructures that are built on the same deck as the turrets are cut away abreast the turrets to permit the guns to be fired across the deck, and are set back several feet from the ship's side to permit fore and aft fire. The conditions will, therefore, approach those in the experiments noted, and it is a matter of conjecture as to what will be the effect upon these superstructures when the 10 inch gun, with a charge of 250 pounds of powder, is fired parallel to them or across the deck through the openings left for that purpose. The vibration is very destructive of light woodwork and filigree work of all kinds, and as the admiral's cabin is within the superstructure of the Maine, it may be necessary to finish it with ornamental sheet iron rather than expensive woodwork, if it is to survive the concussion of the 10 inch gun.

Many of the Hotchkiss guns of the Maine are mounted on the top of the superstructure, and will be in advance of the muzzles of the 10 inch guns when the latter are fired ahead or astern. In the light of the experiments on board the Atlanta and Boston, it would seem probable that the crews of these guns will be deafened or stunned by the discharge of 250 pounds of powder under these conditions.

There are two distinct periods in the discharge of a great gun during which damage may result to surrounding objects. When the projectile leaves the gun, it is followed by a volume of gas at a high tension and moving like the shot at a great velocity. This gas, expanding enormously and moving at a high velocity at the same time, causes a violent blast, driving the air before it, and thus producing in its rear a partial vacuum. This blast, therefore, is the first element of destruction, and carries away everything movable in its path. The air rushing in from all sides to fill this vacuum produced by the blast causes a reaction—an object moved in one direction by the blast would be moved in the opposite direction by the rush of air. This movement of air to restore equilibrium is very violent, and doors are burst open from the inside owing to the excess of pressure on that side. For this reason it is well, when possible, to leave all superstructure doors open, that there may be a free circulation of air, otherwise locks and hinges will be torn off and doors will open themselves.

On both the Maine and Texas, boats, bridges, and superstructures, or hurricane decks, will be immediately over the muzzles of the heavy guns when they are fired across the deck. An inspection of the plans and the theoretical arcs of fire would indicate that all such parts will be destroyed if the limits of train are approached. It may be said, with reason, that in the battle there would be no attempt and no particular necessity for saving these portions of a ship, as they are certain to be destroyed by the enemy's fire, and, therefore, risks, would be taken in order to get in a successful shot, no matter what the consequence might be. Nevertheless, it will be well to reduce as far as possible the danger likely to arise in ordinary practice.

In the Texas two 6 inch guns on the same deck as the turrets and several machine guns and search lights on the hurricane deck above the turrets will be in advance of the muzzles of the 12 inch guns when they are fired in line with the keel. The charge of the 12 inch gun will be about 400 pounds of powder, possibly 500 pounds, and the blast and concussion will be terrible. In the light of present knowledge, it would seem improbable that the crews of the smaller guns can remain at their quarters when the big guns are fired fore and aft. One thing is certain, the plans of ships now in process of construction should be scanned with great care to prevent the possible necessity for expensive and radical changes in the hulls of such vessels and in the disposition of their guns.—*New York Times.*

### Collegians vs. Apprentices.

The question is often asked why educated young men do not succeed as well in obtaining employment as do boys who have grown up in trade, and received their education and experience along with the hard knocks commonly called "getting the eye teeth cut." That the fact, as thus stated, is true cannot be denied. The precise reason would, perhaps, be hard to find, but there are many things which the mind recurs to at once as having a bearing on the subject.

First, college-bred young men are without experience on the practical side of life. The pushing, alert business man is not particularly impressed with the value of a college degree in forecasting the market or determining the value of "job lots," because he knows business is not a theory all, but a hard fact. Then, too, collegians often give themselves superior airs, which do not go down with their associates, the majority of whom have received honorable scars in their fight with circumstances, and have little tenderness for carpet knights. Moreover, the impressionable and formative period of life having been spent in the school room, they have not acquired that alertness, that power to grasp a business situation or problem and instantly solve it. Nothing in their school books taught them the shrewd, watchful readiness competition makes necessary. Their refined mental discipline is almost useless, and at once upon entering the field of trade they find they have a great deal to unlearn. It is not to be denied that a three dollar clerkship and the slow, painful climb to business manhood must seem insulting to a young fellow who can toss off Greek hexameters on call, or deliver an oration on Ciceronian Latin. We are far from denying the value of academic training to the professional man, but the tradesman's requirements are different.

Take the young fellow who left school as soon as he had mastered the rule of three, and entered upon the struggle for existence. His mind was open to all impressions—he learned business without knowing he was learning, as a child learns to talk. He has formed business habits unconsciously. His mind was moulded to alertness, rapidity of thought, promptitude of action, the requirements of business character. Let us illustrate. Take a little fellow of eight or nine years, brought up in a well-regulated home, and place him beside the street Arab, bootblack, or newsboy. On the score of mental activity and practical knowledge and shrewdness, the latter will run him to cover in two minutes. Does not some such difference exist between the educated young man and the one to whom business has been a matter of daily life since early youth, which makes employers prefer the latter? Is there not some way of combining an intellectual with a practical business training which will inure to the benefit of all concerned? We have no desire to discourage intellectual ambition, but the majority of mankind must work for their living, and the time to receive the necessary training for that work must, to accomplish the best results, be commenced in youth.—*Baldwin's Textile Designer.*

### The Nerves and the Moods.

Nothing in nature is more marvelous than the network of nerves constituting what we sometimes carelessly call our nervous system. Each nerve is a telegraphic cord in itself. Each is a part of the whole complex and inimitable system of telegraphy by which messages from the headquarters in the brain are sent to the minute stations in the extremities. If this telegraphic system of nerves were erected on diminutive poles outside of our bodies, it would be a most peculiar exhibit.

Happily for us, our nervous systems are, as it were, a harmonious arrangement of underground wires, carefully buried within us, and deftly concealed from outside observation. We cannot see them, nor know whether they are too slack or too tightly strained We can tell when they are disturbed, for neuralgic agony shoots along their course from station to station. When we are glum, and dismal, and low-spirited, the telegraphic apparatus is out of order, and the nerve forces are demoralized. When nerves work wrong, it is as when telegraphic poles are shaky, or wires tangled or crossed, or currents irregular, or batteries confused.

According to the irregularity of our nerves, so are our irregular moods. If all is right, we are happy and cheery and sunshiny. But let the batteries blunder, or the currents cross, or the wires become entangled, and we are irritable, sulky, ill-tempered, or angry, as the case may be. In some of our distressful moods we pout and sulk, and misinterpret, and misunderstand. We take offense where no offense is intended, and we impute to others motives which are never conceived by them.

At times when the moods are out of sort, we think the whole world is persecuting us, and we, the afflicted objects of persecution, are above all other human creatures singled out for martyrdom. There are circumstances under which most of us can, without insuperable difficulty, rise from the moodiness which is brought about by letting the nerves have their own way. Mental and physical diet has much to do with it. Brooding over real sorrows and imaginary miseries will make the best of us moody and wretched. Nursing grief and affronts and telling the sad story of our woes has as depressing an effect as narcotic drugs.

Sleeping in unventilated rooms often produces chronic wretchedness, even if these rooms be furnished with the appliances of wealth and refinement. Association with grim persons is depressing and dispiriting. Good health, mental, spiritual, and bodily, is worth working for. It casts out the malaria of moodiness and lifts us into the sunlight of joy. Good health is more easily attained than most folks suppose.—*The Christian at Work.*

### The Power of Words.

The effect an advertisement has upon the reader is very well illustrated by the following, as related in the *Mechanical News:*

A wealthy man who owns a country residence recently became dissatisfied with it, and determined to have another. So he instructed a real estate agent famous for his descriptive powers to advertise it in the papers for private sale, but to conceal the location, telling purchasers to apply at his office. In a few days the gentleman happened to see the advertisement, was pleased with the account of the place, showed it to his wife, and the two concluded that it was just what they wanted, and that they would secure it at once. So he went to the office of the agent and told him that the place he had advertised was such a one as he desired and he would purchase it. The agent burst into a laugh, and told him that was a description of his own house where he was then living. He read the advertisement again, cogitated over the "grassy slopes," "beautiful vistas," "smooth lawns," etc., and broke out, "Is it possible? Well, make out my bill for advertising and expenses, for, by George! I wouldn't sell the place now for three times what it cost me."

### THE DYNAMITE CRUISER VESUVIUS.

The dynamite cruiser Vesuvius, launched from Cramp's ship yards at Philadelphia on April 28 of the present year, is now rapidly approaching completion. In a few weeks she is to be ready for her trial trip. The general details of her interior arrangements, disposition of boilers, engines, armament, etc., are shown in the illustrations. She is a vessel of as distinctively new a type as were the monitors of the days of the civil war.

The Vesuvius is a steel ship of 725 tons displacement, 252 feet long over all, and 26½ feet wide. She is without masts, and practically unarmored. She draws a maximum of nine feet of water; the mean draught is eight and one half feet. Her engines, which have been already illustrated and described by us,* are of four-cylinder, triple-expansion type. They actuate twin screws, and are designed to give a speed of at least twenty knots an hour. Her model is naturally characterized by very fine lines, and the boilers and engines are expected to develop 4,000 horse power.

In the forward part of the ship the three pneumatic guns that form her armament are placed. These are built into the ship. Their muzzles are carried forward and project above the deck near the bow. Originally, 16° was chosen as the degree of elevation, but this has been increased to 18° to avoid ricocheting. They are 15 inches in diameter, fifty-four feet long, and are made of thin cast iron. They are not rifled, the vanes upon the projectile being relied on to give any desired axial rotation.

The full-sized shell for this gun is 14¾ inches in diameter, and its body is about seven feet long. Back of the body is a tail fitted with spiral vanes, which secures its alignment and rotation. The body is made of thin drawn brass tubing, and will hold 600 lb. of high explosive, dynamite or gelatine, the whole weighing about 1,500 lb. when charged. This is the largest shell the gun can fire, and the effects of such a heavy charge of explosive can only be surmised. The destruction of the Silliman, one mile distant from the gun, was accomplished with fifty-pound charges. The Vesuvius is to throw torpedoes containing twelve times this quantity. Should one explode in the air over a ship, the effects of the concussion on her crew would probably be very disastrous. According to the opinion of students of torpedo practice, the submarine explosion of such a shell would destroy a ship twenty or more feet distant.

By a recent improvement the range of adaptability of the guns is greatly increased. Sub-caliber shells can be fired with accuracy, and give an increased range. Thus with the fifteen inch gun built for the Italian government the following ranges have been attained:

| | | | | | | |
|---|---|---|---|---|---|---|
| Full | caliber | projectile | weighing | 1,029 lb. | 18° elev. | 1,160 yds. |
| Sub | " | " | " | 950 " | 25 " | 1,644 " |
| " | " | " | " | 155 " | 18 " | 3,452 " |
| " | " | " | " | 300 " | 10 " | 2,804 " |

The two last projectiles were eight inches in diameter.

The air for discharging the projectiles is compressed by two Norwalk compressors into reservoirs consisting of a number of tubes. These are made of wrought iron, 16 inches in diameter, and thirteen-sixteenths inch thick. The heads are concave and are welded into place, and the ends are then reduced in size to still further increase the strength. Some of the tubes are twenty and others are twenty-five feet in length. As will be found on calculation, each lineal foot corresponds pretty closely to one cubic foot capacity. The firing reservoirs contain 210 cubic feet of compressed air, the storage reservoirs contain 420. It is proposed to store the air at 2,000 pounds pressure per square inch, the compressor being able to deliver 140 cubic feet of air at that pressure every hour. The firing reservoir is to be maintained at a pressure of 1,000 pounds. Each shot at one mile range reduces its pressure 150 pounds. This deficit is immediately supplied from the storage reservoir.

Under the rear of each gun are placed two "revolvers" in line with each other. Each contains five chambers, for holding as many torpedoes. To load a gun, its breech is dropped, swinging downward on a pivot at its extreme rearward end. The opening points forward and comes directly opposite and in line with the lowest chamber of the after revolver. By a hydraulic ram the shell is pushed into the breech, which is at once swung upward, again completing the continuity of the barrel. The revolver is then turned one division, so as to be ready for supplying a second shell. When the after revolver is empty it is filled from the forward one in the same way. All these manœuvers are executed by hydraulic power.

Thus for each gun ten projectiles are provided, giving a total of thirty. This is the full armament of the ship as far as torpedoes are concerned.

The guns are provided with two valves. One is the graduated firing valve, the other is the throttle valve. It was thought that by adjustable reduction of area by a fixed valve, in addition to the firing valve action, more accurate results as to range might be attained.

* See SCIENTIFIC AMERICAN, May 19, 1888.

The ship is steered by steam. All of her operations will be directed or executed from a conning tower placed on her deck. The tower is protected by light armor. In firing, the guns have a fixed elevation. Their range is varied by admitting more or less air. This is effected by the firing valve, which is constructed so that any desired amount may be used with certainty. The pointing of the guns is to be executed by the movements of the vessel. The officer in the conning tower will have under his control the ship with her guns to be trained upon the enemy, in the same sense that an artillery officer moves his gun carriage about so as to point in the desired direction the piece it carries. The hull of the Vesuvius represents a gun carriage carrying three pneumatic guns.

The contract requirements are that the ship shall have a speed of twenty knots per hour. The guns are to be able to throw a projectile containing two hundred pounds of explosive a distance of one mile. One shot each two minutes is to be fired for nine shots. The guns are to be of sufficient accuracy to drop the projectiles within a parallelogram fifty feet wide and two hundred feet long.

An item of interest in connection with this matter is the appropriation by Congress of $400,000 for pneumatic guns for the United States army. Ten guns will probably be built, to be mounted for coast defense. The colony of Victoria, Australia, and Italy have ordered them, and other governments are in negotiation with the pneumatic gun company. In case of war with a foreign power it seems probable that the United States would have to meet these weapons in the enemy's ranks. She will not be allowed to monopolize so deadly a weapon.

### How the Tiger Kills and Eats.

In a paper read before the Bombay Natural History Society recently, and published in its journal, Mr. Inverarity, a noted *shikari*, discussed the habits of the tiger, and especially the mode in which it kills and eats its prey. Some think he seizes by the throat, others by the nape of the neck from above.

Mr. Inverarity has examined scores of slain animals with special reference to this point, and in every case but one the throat was seized from below. The exception was an old boar who had been seized by the back of the neck from above. One of a single file of villagers who was once seized by the nape of the neck by a man eater, but saved by his companions, had no idea when he recovered his senses what had happened. Whether dislocation of the neck takes place is doubtful.

The tame hunting leopards always kill by pressure on the windpipe, without breaking the skin; possibly the tiger kills in the same way. It is only by accident, if at all, that tigers in killing sever any important vein or artery, and no blood to speak of flows from the throat wounds. Very large and powerful animals like the bull, buffalo, and bison, if attacked at all, are in the first instance attacked from the rear, with a view to disable them.

Having killed, the tiger almost invariably begins eating a hind quarter, consuming one or probably both. Sometimes he leaves the stomach and intestines as they are; sometimes he will remove them to one side, making a neat parcel of them. A tiger and tigress together will finish an ordinary sized animal at one meal, leaving only the head. In this case it is probable that the second begins at the fore quarter. Animals are never eaten where they are killed, but are always dragged a short distance. They are not lifted clear of the ground, but dragged.

Having gorged himself, the tiger sometimes lies close by his prey, but if it is hot weather and there are hills in the neighborhood, he will go a long distance off before resting for the day. He prefers to lie in a cool cave or in a breeze on the hill side than in the close, hot jungle

He returns next night and finishes what is left, but he never eats a second time on the same spot, dragging the remains of the prey 40 or 50 yards off. Sportsmen coming on a half-devoured animal and desiring to catch the tiger, tie the prey to a tree. The tiger takes about two hours' steady eating to finish the fore quarters of a bullock.

Mr. Inverarity sat over a small tigress one night who ate for ten minutes, then went away for twenty, probably to drink, and on her return ate steadily for two and a quarter hours. He did not fire, as he could not see her.

Tigers are cannibals; they will make their meals off each other. They are supposed to kill once in five or six days, and no doubt the tiger after a heavy feed does not care to hunt much for a few days; but a tiger kills whenever he can. They have been known to kill on fourteen consecutive nights.

Mr. Inverarity believes that animals killed by tigers suffer little beyond the panic of a few seconds. The shock produces a stupor and dreaminess in which there is no sense of pain or feeling of terror. The powerful stroke of the fore paw of the tiger is a fiction; he clutches with his claws as one might with the fingers, but does not strike a blow.

Tigers wander immense distances at night, and, as they like easy going, they go on roads and paths. They do not like to move during the heat of the day, as the hot ground burns their pads and makes them raw. They can on occasion climb trees.

In Salsette one climbed after a certain Pandoo, but could not reach him, and retired. Pandoo, thinking the coast clear, got down and ran toward home, but on the way was caught by the tiger and killed.

The inquest report stated that "Pandoo died of the tiger eating him; there was no other cause of death. Nothing was left except some fingers, which probably belonged to the right or left hand." Natives have a belief that the ghosts of the man-eater's victims ride in his head and warn him of danger, or point the way to fresh victims.

### Good Words from Our Contemporaries.

What some of our contemporary exchanges think of the SCIENTIFIC AMERICAN.

The SCIENTIFIC AMERICAN, published by Munn & Co., New York, during more than forty years, is, beyond all question, the leading paper relating to science, mechanics, and inventions, published on this continent. Each weekly issue presents the latest scientific topics in an interesting and reliable manner, accompanied with engravings prepared expressly to demonstrate the subjects. The SCIENTIFIC AMERICAN is invaluable to every person desiring to keep pace with the inventions and discoveries of the day.—*Chester Village Record.*

The SCIENTIFIC AMERICAN has long held the first rank among the leading publications regarding practical information about art, sciences, mechanics, chemistry, inventions, and manufactures. No one who wishes to keep acquainted with the rapid advancement along these lines can dispense with it. Munn & Co., 361 Broadway, New York. Price, $3 a year; 10 cents a number.—*Chautauqua Herald.*

SCIENTIFIC AMERICAN.—Every week this most valuable periodical presents whatever is new in the world of science, art, and manufactures. Full of practical information, it discloses to the thoughtful not only what has been ascertained, but also suggests the possibilities still to be revealed. For more than *forty years* Munn & Co. have conducted this paper in connection with the procuring of patents for new inventions. The SCIENTIFIC AMERICAN is authority for all scientific and mechanical subjects, and should be in every household.—*The American Israelite, Chicago.*

The SCIENTIFIC AMERICAN.—After the moral and religious instruction of the family is secured, we know of nothing more interesting and instructive than a record of the progress of modern science and its marvelous achievements. And we know no medium which presents such a record in so full and readable a manner as that well known weekly, the SCIENTIFIC AMERICAN, established over forty years. It will promote industry, progress, thrift, and intelligence wherever it is read. It is of special value to every machinist, mechanic, or engineer, but is also of use to the farming and mercantile community, on account of its illustrated notes on farming, fencing, farm buildings. $3 a year.—*The Home and School (Toronto, Canada).*

There are few publications of which we can speak so unreservedly in praise as the SCIENTIFIC AMERICAN. No manufacturer or artisan should be deprived of its weekly visits. It is abreast of the practical scientific thought of the day, and there is nothing of importance occurring here or abroad that is not promptly and faithfully reflected in its pages. The SUPPLEMENT, also issued each week, is a desirable addition to the library of every wide-awake business man.—*The Harness*

The SCIENTIFIC AMERICAN is a welcome weekly visitor at our office. The intelligent reader will always find pleasure in its perusal, even if he is not specially devoted to the arts and sciences. The monthly ARCHITECTS AND BUILDERS EDITION is always opened by us with special pleasure and interest. Full of plans and suggestions on the subject of building structures of all kinds and prices, it is a very treasure house of valuable matter for architects and builders, and to any one contemplating the erection of a home, almost any number is worth a year's subscription price.—*Pittsburg Christian Advocate.*

The SCIENTIFIC AMERICAN, published by the great patent agency firm of Munn & Co., New York, is the most practically useful publication of its kind in the country. Indeed, it occupies a field distinctively its own. Not alone for the machinist, manufacturer, or scientist, but it is a journal for *popular* perusal and study. It is the standard authority on scientific and mechanical subjects. It is placed at a very low rate of subscription, $3 per annum, which places it within the reach of all.—*Faith and Works.*

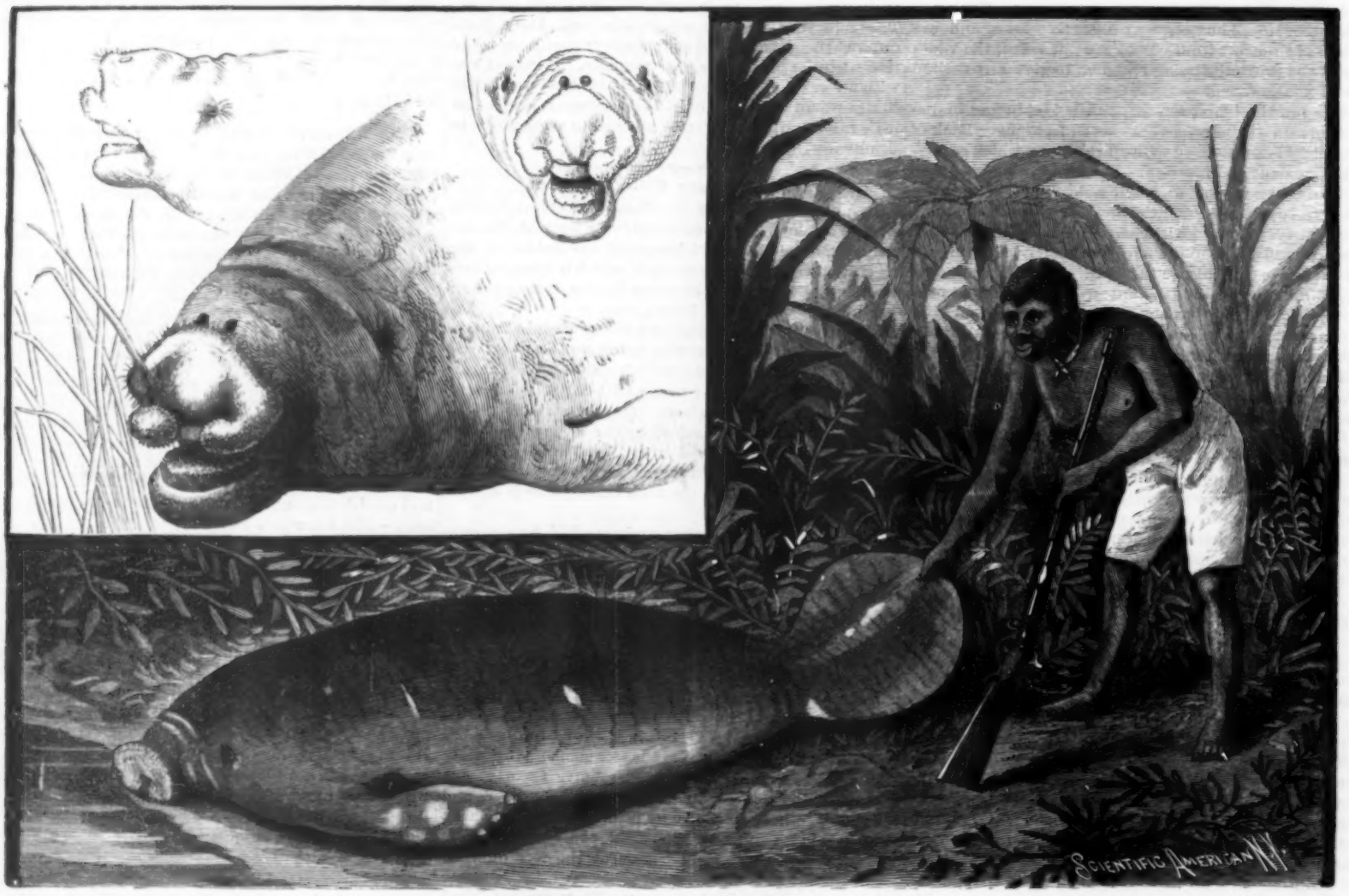
## THE FLORIDA MANATEE.

JOHN R. CORTELL.

The manatee was formerly classed with the whales as a cetacean, but it is now placed in an order—Sirenia—with its cousins-german, the dugong and the rhytina. It is like the whale in being an aquatic mammal, but differs from it in many important particulars. The rhytina (*R. gigas*) was exterminated many years ago by the ships' crews which went ashore in the neighborhood of Behring Straits, the only locality where it has ever been found. It was found to be not only good and palatable food, but so unsuspicious an animal that it fell an easy prey to its enemies. Stellar, a German naturalist, was fortunate enough to see the animal before its total destruction and to study its habits, so that he was enabled to publish a full account of it. It was the largest of its order, measuring as many as twenty-five feet in length.

The dugong (*Halicore*), of which there are three species, is found in sufficiently plentiful numbers, all the way from the southwestern coast of Asia to Australia.

Of the manatee there are three species—the west African coast (*M. senegalensis*), the South American (*M. americanus*), and the Floridan (*M. latirostris*).




THE FLORIDA MANATEE.

The latter species, which is the one now claiming consideration here, is found all along the Florida coast, keeping always as near a fresh water inlet as possible. The dugong ventures out boldly into the ocean, but the manatee, though quite as good a swimmer, prefers the vicinity of the coast. Indeed, it is more contented in fresh water than in salt, and from choice generally feeds in the inlets of the rivers, the rank growth of seaweed lining the shores affording it food without the necessity of diving to the depths of the ocean for it. It is entirely an herbaceous feeder, its teeth being fitted for no other sort of food. It has no teeth in the front of the jaws, differing in this respect from the dugong, which has incisors, and has only the molars. The rhytina, differing still further, had no teeth at all, rough, horny plates taking their place.

The manatee has no need of front teeth, but it has need for some means of drawing its slippery, undulating food into its mouth; and this is provided in the singular modification of the lips and jaws. The latter are bent slightly downward, and the former are not only prehensile to a slight degree, but are furnished with an apparatus peculiarly adapted to the character of the food to be taken into the mouth. The upper lip in repose is a heavy flap of flesh, covered on the under side with gristle-like bristles as thick as a knitting needle, with the same rounded point, and about half an inch in length. When there is seaweed to be taken into the mouth, however, the lower lip drops and the upper one divides at the middle and elongates on each side, the bristles taking the form, on each portion of the lip, of a hemisphere. These two hemispheres roll inward toward each other, grasping the seaweed and conveying it into the mouth until it is under the grinders.

The head of the manatee is very small, and there is no indication of neck at its junction with the body, which immediately begins to swell out and continues so to do until it has reached its greatest width, a little forward of the mid-distance of the total length, after which it commences to taper toward the tail. The tail, like that of the whale, is placed horizontally instead of vertically, as in the fishes. But instead of being fluked, as with the whale, it is rounded and considerably depressed. It is entirely devoid of anything in the nature of a dorsal fin, but it has the flippers which correspond with the hands of man and which indicate the fore limbs of the land mammals. There is no external trace of the hind limbs, but two pelvic bones in a rudimentary condition are found within the body to show the relationship of the creature to the four-footed kind.

The flippers are very movable, and are not only in respect of skeletal condition the counterpart of the human hands, but in their uses as well. They do not present externally any likeness to the hand, but such need as the manatee has of hands these flippers serve. They have at least given the animal its name (from *manus*, the hand), and, if the theory be true, helped to deceive the sailors of ancient days into the belief that the sea was really peopled. Being a mammal, it of course brings forth its young as other mammals do, and then nourishes it with milk from its own breasts. The breasts are two in number, and placed as in the human animal, so that when the manatee holds its little one to the breast with one of its flippers and rises to the surface to breathe, it might at a sufficient distance, and by use of a trifle of imagination, be conceived to resemble a human mother. That it is the prototype of the ravishing siren of legend is hard to have to believe, however, and the myth destroyers ought really seek further for the original of the seductive songstress.

The hide of the manatee is thick, coarse in texture, and of a dark color on the back, running to a dark slate color on the belly. It is but sparsely grown with coarse hair, and gives the appearance of being hairless. The flesh is of a flavor between beef and pork, and is in great demand in Florida, where it is permitted by the Church to be eaten on Friday as fish. For this reason it is fast going the way of its unfortunate cousin, the rhytina—being destroyed in greater numbers than it can replace. Like its relative, too, it is easy to capture and easy of access, going as it does into the inlets and estuaries to feed, and being obliged to seek the surface as often as every seven minutes to take in a fresh supply of air.

The skeleton of the manatee offers a strong contrast to that of the whales, in being much more strongly framed, in having the head joined in such a manner that, although there is no external sign of a neck, the animal is able to move its head freely, and in the fact that the ribs are more strongly curved, rising from the backbone and making a bold sweep upward before circling round to inclose the vital parts. The bones, too, are radically different, being heavy, solid, and ivory-like, whereas those of the whale are light and hollow, frequently being filled with oil.

In ordinary swimming, the tail is used with a sculling motion, but when driven to its greatest speed the tail is twisted into a vertical position, carried up over the back and then brought back in the horizontal position with extraordinary force and elasticity. Then it is carried under the body and back again in the same fashion, and so on. The result is a very high rate of speed, estimated by Captain J. W. Zellers, who has had a long experience in capturing the animal, at not much less than twenty miles an hour. The illustrations are from three of these creatures, which Captain Zellers captured in the Indian River inlet and brought to New York, where he exhibited them in a shallow tank in South Street, near Fulton Ferry.

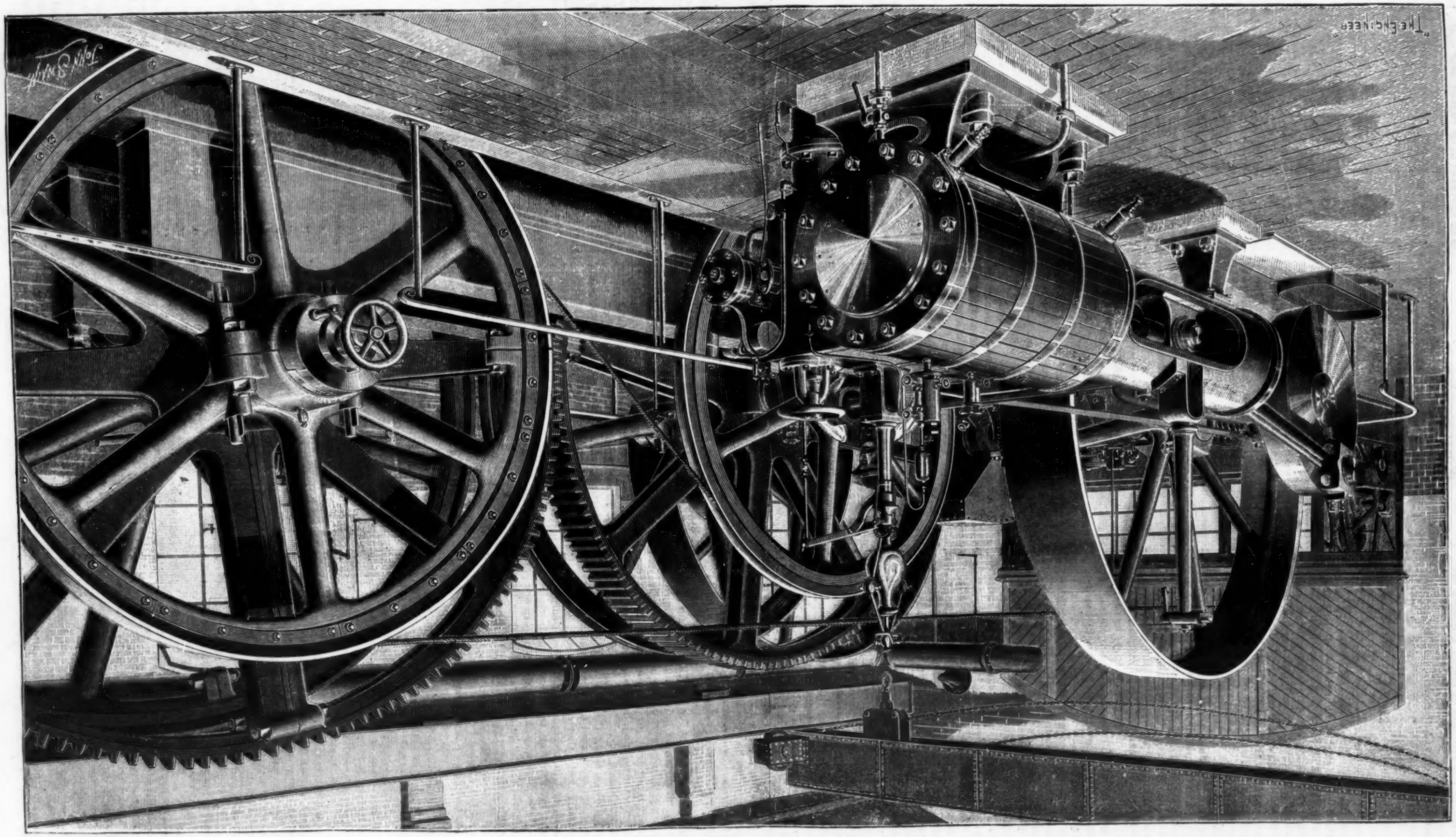
It has been commonly supposed that the manatee will not live in captivity, but the experience with the three mentioned would seem to conclusively prove the contrary. When seen by the writer they had all been in captivity for three months and showed no signs of distress. They ate well, even of unfamiliar food, and gave no indications of suffering in any way. Their docility is rather that of stupidity, though they are sufficiently intelligent to approach when called at other times than for feeding. The female when called by name would give faint but unmistakable signs of recognizing the voice of her keeper.

According to Captain Zellers, the manatee attains a length of 18 feet occasionally and a weight then of nearly or quite 3,000 pounds. The largest of his specimens was 9 feet 2 inches in length and weighed something short of 800 pounds. One of these specimens had been kept out of water for as long as seven days at a stretch, without any discernible evil effects. This is noteworthy from the fact that the manatee not only never goes on land voluntarily, but is unable to make any progression there.

The mode of capturing the creature alive is very simple, and well illustrates the facility with which it may be exterminated unless some steps be taken to preserve it. When a manatee is seen out in the water, a long and strong net is thrown out around it, and then the fishing schooner is made to beat back and forth until the animal is driven into the net. As soon as that is accomplished, care is taken to get the head or the frightened creature above water before it can drown, and then it is hoisted to the deck of the schooner by means of the davits. It makes no resistance, all its

THE BIRMINGHAM CABLE TRAMWAYS—ENGINES AND WINDING GEAR.

[For description see page 280.]



efforts being in the direction of stupid attempts to escape.

If properly taken care of, there seems no reason why this animal should not take its place in our zoological gardens, and surely as the original mermaid it is imperative that it should be a part of the curiosities of the traveling menageries.

## BIRMINGHAM CABLE RAILWAY.

Cable railways are now being introduced in England. We present herewith an engraving of the engines used for driving the Birmingham cable, for which we are indebted to the *Engineer*. This machinery has been made by Messrs. Tangye, Birmingham.

The engines have jacketed cylinders 24 in. diameter by 48 in. stroke, and run fifty revolutions per minute; they are fitted with Jefferiss' automatic expansion gear. The piston rods, 4 in. diameter, are of steel; the steam pipes 6 in. diameter, and exhaust pipes 8 in. diameter. A main equilibrium stop valve is placed in a convenient position, so that the engineer can have full view of his engines. Under each fly wheel a powerful steam brake is fixed, so that the engines can be stopped immediately any accident happens to the rope. The exhaust pipe from the cylinders has a by-pass, by means of which the exhaust steam, instead of going through the heater, can be utilized in the injectors for feeding the boilers.

The crossheads are fitted with gun metal adjustable soles; the pins are of steel, but the connecting rods are of wrought iron. The fly wheels are 15 ft. diameter and 2 ft. in width; they are made in two parts, secured together by turned bolts. They are turned on the face, and weigh about 8 tons each. The main shaft is of steel, and is 9¼ in. diameter at the bearings, which have wedge adjustment and are in three parts. The pinion on the main shaft is 5 ft. 4⅝ in. diameter, the large spur wheels are 13 ft. 11⅛ in. diameter at the pitch line; all these are in halves, planed and connected by the bolts.

The barring arrangement consists of a pair of Tangye's vertical Archer engines, with cylinders 6 in. diameter and 7 in. stroke, which drive a pinion geared into a spur wheel fixed to a shaft on which is a worm gearing into a worm wheel attached to a secondary shaft which can be coupled to either of the main engine shafts; and when the main engines are once started they throw the worm out of gear, and when once out of gear it is held there by a catch. Either or both engines may be thrown out of gear by means of clutches. The main pinion and the large spur wheels are fixed to the shafts, but the large grooved pulleys are made fast or loose by means of the clutches at the ends of the spindles carrying them and the hand wheels.

The rope driving pulleys for the Birmingham service are 10 ft. diameter, in halves, and are also provided with jaw couplings cast on the boss at one side. The periphery is grooved for the rope, and is lined with compressed beechwood, held in position by segments bolted on at one side.

The carry pulleys along the line are placed 28 ft. apart; the yokes are placed 4 ft. apart; the radius of sharpest curve, namely, that at Colmore row, is 45 ft. on a gradient of 1 in 20-28; a very awkward corner. The steepest gradients on the route, 1 in 20—Snow Hill. The permanent way of the extension to Handsworth, which will shortly be constructed, is about 1⅗ miles in length, and is also to be double line throughout.

There is a 6 ton overhead traveler, which runs the length of the building on beams supported at the side walls, and consists of two wrought iron end carriages mounted on wheels, two wrought iron girders, and a compact lifting gear or crab fixed at one end, so that all motions can be worked from the side. The crab is self-sustaining, and the weight can either be lowered by pulling the chains or releasing the brake. The span of the traveler is 37 ft. 9 in.

## A Snake Siphon.

Old Sergeant Subers relates the following as strictly true, and says it can be vouched for by forty of the most influential citizens of East Macon:

Out on the plantation of Mr. J. G. Evans, near Macon, there are a great many moccasins, especially about the mill pond. One little pond near the mill is a favorite resort, and they congregate in great numbers about it. It is supplied by the rains, and last summer, during the protracted drought, it went almost dry, with a great number of snakes to mourn the loss of the water. The snakes did not like to be evicted by dry weather, so they crawled out in single file from the little pond that lay below the level of the mill pond. When the first snake, or leader, had reached the water of the mill pond a halt was called, and each snake proceeded to swallow the tail of the snake in front of him, until each mouth was filled with a tail, and then every snake in the long line proceeded to shed its skin and crawl out. The shed skins formed a long length of hose, which, acting like a siphon, drew the water from the mill pond and filled the little pond, and, what is better, kept it full all summer.—*Macon Telegraph.*

# Correspondence.

### A Letter Envelope Gum Moistener.

*To the Editor of the Scientific American:*

Referring to your article on page 234 of the SCIENTIFIC AMERICAN for October 13, 1888, where you say, "Any one who closes a letter in the ordinary manner finds the lips soiled and a villainous taste left in the mouth," a convenient device for making it unnecessary for any one to use the mouth in closing a letter is as follows: Take an ordinary glass alcohol lamp, having a glass cover; remove the metallic wick tube, fill the lamp with pure water and insert candle wick sufficient to close the opening, but allow sufficient moisture of the wick to moisten envelopes. If the cover is kept on when not in use, it will remain clean for some time, and the wicking is easily replaced when it becomes soiled.

However pure the gum on an envelope may be, no one should venture to moisten it with the tongue or lips, because disease germs may attach themselves to the cleanest gum. HENRY B. BAKER.

Lansing, Mich., Oct. 16, 1888.

### Burners for Lamps—A Suggestion.

*To the Editor of the Scientific American:*

Will you please call the attention of those brass workers who furnish the burners of our kerosene lamps to a defect in their construction, the difficulty of rubbing or cleansing the lower surface, owing to the way they are constructed or put together. Civilization is, in great degree, a question of light, light is a question of combustion, combustion of draught. The draught in a kerosene lamp is, of course, through the holes in the perforated brass plate. Even when the plate is kept tolerably free from accumulations of dust, lint, and particles of the burnt wick, a film of oil is sure to form, which extends over the holes, and in great part closes them, unless it is carefully removed. A dull, red, smoky light is the result, owing to imperfect combustion. The cleansing is best done by rubbing with dry paper. But it is always troublesome to cleanse the under side, as burners are now constructed, either with paper, or cloth, or by machinery, owing to the rivets and the roughness of the brasswork. The film of oil is the consequence of evaporation from the wick and condensation on the cold metal. Consequently, some convenient way of covering the wick to prevent this evaporation, when the lamp is not in use, would be a valuable improvement.

HENRY U. SWINNERTON, Ph.D.

Cherry Valley, N. Y., October, 1888.

### Our Fuel Supply.

*To the Editor of the Scientific American:*

In a recent number of the SCIENTIFIC AMERICAN there appeared an article, selected from a deservedly well known journal, upon the waste of anthracite at our mines and the early exhaustion of its supply, in which the following startling statement is made: "*At the present rate of production and present percentage of waste in mining, our entire supply of anthracite coal will last only 75 years.*"

However exaggerated, if at all so, the above statement may be, there is no reason to doubt, based as it was upon statistics from data by the Geological Survey of Pennsylvania, that there is much truth in it, and the sooner measures be taken to stop waste at our mines, the better.

But there is another view to take of the fuel question. In this utilitarian age economy in use forms an important factor, and in no material is this consideration of more importance than in the coal we burn, especially when we regard the increasing demand for the article in our works of industry, including those connected with commerce and travel, and last, not least, when we reflect upon the necessities of the poor, to whom cheap fuel and an economical use of it is a serious matter.

Now the question arises, Do we economize in the use of our fuel to the extent we might do? That there is much heat wasted in the combustion of fuel by our present methods is certain. Take our stoves and furnaces for domestic purposes by way of illustration. How much heat is lost by absorption in these structures themselves, especially in cast iron stoves of a heavy construction decorated with senseless ornaments, and from which radiation is too slow or imperfect to be appreciable! How much, too, is wasted by pipes conducting the heat to where it is needed, by radiation in directions where it is not felt, by escape of the heated gases and smoke up the chimney, and by an imperfect combustion of the fuel itself, as also in various other ways! We have often heard of smoke-consuming furnaces as applied to steam boilers. Cannot some of your readers devise a smoke and gas consuming stove or heater that will render all connection with the chimney, except for the purpose of draught upon starting a fire, if even then, unnecessary; that will stand out in an apartment and do its duty in an isolated manner, possibly dispensing with chimneys to our houses; that will quickly radiate the heat generated within it; and that in the combustion of its fuel will leave no cinders to be wasted or to be burned over again, but will abstract, once for all, all the available heat to be derived? A new departure may be necessary to accomplish these results, or most of them, but generally important and profitable inventions are made by deviating from the beaten track.

Again, as regards fuel itself. If coal is shortly to become scarce and dearer, then substitutes must and will be found. There have been numerous attempts in this direction already, including the use of various combustible materials and binders with coal dust: gas, mainly used for illuminating purposes, obtained from water, which, strange to think, is composed of but two elements, one of which, in its gaseous state, when mixed with or exposed to atmospheric air, is one of the most inflammable materials in nature, and the other the most active supporter of combustion; various oils, too, and different materials; but none of these, so far, has been able to supply the want. Other available substances, however, may be found, or some chemical mixtures be discovered which, either alone or in connection with ordinary fuel, will accomplish the desired result. No one would object to the adulteration of coal, especially the free-burning kind, if the foreign matter added improved and economized the combustion of such fuel. We live in an age of progress and surprises, and there are chemical substances, both solid and fluid, which by being simply brought in contact produce heat; powders, too, which take fire on exposure to the air, and various materials that ignite and give out heat under the slightest provocation.

What is to be the fuel of the future would be a difficult question to answer, but the vast importance of the subjects I have broached makes them worthy at least of serious consideration. ENQUIRER.

Newark, N. J., Oct. 12, 1888.

### The Mean Composition.

MM. Yvon and Berlioz have published (*Rev. de Med.*, Sept.) a series of tables of the analysis of normal urine. Their observations were very numerous, and made on healthy adults, male and female. Their results are contrasted with those of other authors, and in each case they give the maxima and minima, as well as the means. The latter are summarized thus:

| | Male. | Female. |
|---|---|---|
| Volume (cub. centim.) | 1360·0 | 1100·0 |
| Density (sp. gr.) | 1022·5 | 1021·5 |
| Urea (in grms.) per liter | 21·5 | 19·0 |
| " " per 24 hours | 26·5 | 20·5 |
| Uric acid (in grms.) per liter | 0·5 | 0·55 |
| " " " per 24 hours | 0·6 | 0·57 |
| Phosphoric acid (in grms.) per liter | 2·5 | 2·4 |
| " " per 24 hours | 3·2 | 2·6 |

Thus, with the exception of uric acid, the amounts are higher on each head among males than among females; but with uric acid the quantities eliminated are almost precisely the same for the two sexes. MM. Yvon and Berlioz desire also to correct, as resulting from these observations, the proportionate quantities of urea and uric acid given in their Manual of Urinary Analysis, which should be as 40 : 1 instead of 30 : 1; and of urea and phosphoric acid, which should be as 8 : 1 instead of 10 : 1.

### Effect of Coffee.

Dr. Dumont, of Louvain, has undertaken a series of researches on the effect of coffee drinking on the urine, from which it appears that, though the diurnal quantity of urine is not seriously interfered with, the composition undergoes a very decided change. Dr. Dumont kept the subjects of his researches for some days on ordinary diet, the constituents of which were determined. During part of the time only was coffee added, the quantity being three cups—corresponding to about two ounces of roasted coffee—per diem. By regular and careful analyses of the urine, it was found that during the days when coffee was taken the urea passed was increased by about seventy-five grains. The effect on the urea was produced immediately the coffee was commenced, and as soon as it was omitted the quantity of urea returned to that which it had exhibited previously.

### Cotton Fabric a Substitute for Jute for Bale Covers.

The new plan of using a cotton fabric for covering cotton bales, instead of jute, is finding favor at the South. The cotton cover, it appears, is the most economical, the saving being equivalent to a gain of 16 lb. of cotton per bale, as follows:

| | |
|---|---|
| Difference of weight saved by using cotton fabric | 8 pounds. |
| Saving by the better protection of this new fabric, at least | 3 pounds. |
| Cotton saved which is now lost by sticking to jute bagging | 1 pound. |
| Value of second hand cotton bagging, less value of second hand jute bagging | 3 pounds. |
| Saving by use of cotton, on account of insurance, at least equivalent to | 1 pound. |
| Total | 16 pounds. |

The Maginnis Mills, of New Orleans, and the Lane Mills, of New Orleans, allow ten pounds extra weight on every bale of cotton covered with the new cotton bagging.

### Adulteration of Condiments.

The microscopist of the Department of Agriculture, Prof. Thomas Taylor, has begun an examination of the condiments of commerce for the purpose of ascertaining which of them are adulterated, the methods and extent of the adulteration, and of discovering methods by which the consumer may detect impure articles.

The first article treated was pepper, and the method of the investigation is here briefly described. A section of a pepper corn is placed under a microscope and magnified one hundred and fifty diameters. Its appearance is carefully noted and photographed, and a drawing in colors is made, showing exactly how it looks. The pure powder of pepper corns is then treated in the same way, and, from a comparison of the image of this with that of the section, the changes caused by grinding may be noted. The next step was to examine specimens of the pepper of commerce to ascertain if it presented the same appearance as the pure pepper already photographed and drawn. In a majority of cases it did not, the differences being so striking as to mark it as an entirely different article.

Professor Taylor has ascertained that the substance used in adulterating pepper is the seed or stone of the olive. These are obtained in large quantities from the olive oil factories, and ground up with the pepper corns, the extent of the adulteration being in some cases as great as fifty per cent.

No method of popularly detecting adulteration of pepper has yet been found. In bulk the pure pepper is darker in color than that to which olive seeds have been added; but the difference is so slight that no person, unless possessed of a sample to compare with, would be able to discover any difference.—*Science.*

### Sonorous Sand.

At the last meeting of the New York Academy of Sciences, Dr. A. Julien and Prof. H. C. Bolton gave a report of the interesting results of their long continued researches on sonorous sands. The cause of this remarkable phenomenon, which was first known to occur in Arabia, has long been a mystery. In course of time many other localities in which sonorous sands occur became known, and, in fact, it may be found almost everywhere on beaches and in deserts. The authors collected samples from all parts of the world, and on close examination, found that all sonorous sands are clean; that no dust or silt is found mixed with the sand; that the diameter of the angular or rounded grains ranges between 0·3 and 0·5 of a millimeter; and that the material may be siliceous, calcareous, or any other, provided its specific gravity is not very great. When these sands are moistened by rain or by the rising tide, and the moisture is evaporated, a film of condensed air is formed on the surface of each grain, which acts as an elastic cushion, and enables the sand to vibrate when disturbed. In sands mixed with silt or dust, these small particles prevent the formation of a continuous air cushion, and therefore such sands are not sonorous. If this theory be correct, sonorous sand must become mute by removing the film of air. Experiments of the authors prove that by heating, rubbing, and shaking the sand is "killed." All these operations tend to destroy the film of air condensed on the surfaces. On the other hand, samples of sonorous sand were exhibited which had been kept undisturbed for many years. They had retained their sonorousness but, after having been rubbed for some time, became almost mute. The theory advanced by the authors appears very plausible, and will be firmly established when they succeed in making a sonorous sand. Their experiments in this line have not yet been completed, but promise fair success.—*Science.*

### The Commercial Value of Old Boots and Shoes.

The *Journal* of the Constantinople Chamber of Commerce describes the industrial uses of old boots and shoes which are thrown out into the streets or into ash pits. After being collected, they are ripped open, and the leather is subjected to a treatment which renders it a pliable mass, from which a kind of artistic leather is derived. This, in appearance, resembles the finest Cordova leather. In the United States patterns are stamped on this, while in France it is used to cover trunks and boxes. The old boots and shoes are also treated in another way, by which they are converted into new ones. The prisoners in Central France are employed in this way, the old shoes coming chiefly from Spain.

They are taken to pieces as before, the nails being all removed, and the leather is soaked in water to soften it. The uppers for children's shoes are then cut from it. The soles are also used, for from the smaller pieces of the leather of the old soles the so-called Louis XV. heels for ladies' shoes are made, while the soles of children's shoes are made from the larger and thinner pieces. The old nails are also put to use, for by means of magnets the iron nails and the tacks and brads are separated and sold. The contractors of the military prison at Montpellier say that these nails alone pay for the old shoes. Nothing now remains but the scraps, and these have also their value, for they are much sought after by certain specialists for agricultural purposes.

### MICROSCOPICAL NOTES.

At a recent meeting of the microscopical section of the Brooklyn Institute, Dr. S. E. Stiles, of Brooklyn, New York, exhibited samples of a new wax cell, and demonstrated the method of constructing the cell and mounting objects therein.

The cell is so simple in construction, so beautiful in appearance, and so effective, that we illustrate the method, and give a brief description of it for the benefit of our readers.

Sheet wax, such as is used by the makers of artificial flowers, is the material employed in the construction of this cell. Three or four sheets of different colors are

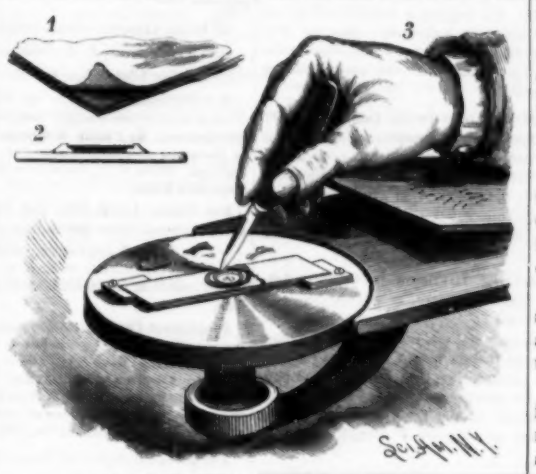



Fig. 1.—MAKING THE WAX CELL.

pressed together by the thumb and finger to cause them to adhere, and a square of the combined sheet thus formed of sufficient size for a cell is cut out and pressed upon a glass slide. The slide is then placed upon a turn table, as shown at 3, Fig. 1, when, by the dextrous manipulation of an ordinary penknife, the wax is cut into a circular form, and the center is cut out to the required depth. If the cell is to contain a transparent or translucent object, the entire central portion of the wax is removed, as shown at 2, Fig. 1; but if a ground is required for the object, one or more layers of wax are allowed to remain. A portion of the upper layer of wax is removed to form a rim for the reception of the cover glass. Where a black ground is required, a small disk of black paper is pressed upon the lower layer of wax. The final finish is given to the cell by a coating of shellac varnish, applied while the slide is on the turn table. These cells are very quickly made and have the finished appearance of a cell formed of different colored cements.

Mr. Stephen Helm, of the Royal Microscopic Society, who is also a member of the microscopical section of the Brooklyn Institute, described a simple and very efficient method of gathering pond life, and exhibited the implements, as well as a large quantity of material secured by his method. The objects are gathered by means of a wide-mouthed bottle clamped in tongs attached to a long handle, cane, or even a fishing rod. By means of this device mud can be removed from the

Fig. 2.—IMPLEMENTS FOR GATHERING MICROSCOPIC OBJECTS.

bottom, the stems and leaves of aquatic plants can be scraped so as to remove animalcules, and objects can be readily dipped from pools and shallow places. To concentrate the material, Mr. Helm employs a wide-mouthed bottle or jar provided with a perforated cork, in which is inserted a funnel for receiving the material, and another funnel is inverted and placed within the jar or bottle, with its nozzle extending upward through the stopper. Over the lower end of this funnel is stretched a piece of thin muslin, and to the upper end is applied a short piece of rubber pipe which is retained in a curved position by a thread tied around the neck of the bottle. The material gathered is poured into the funnel, the water escapes through the strainer, and the objects are retained in the bottle. Mr. Helm said that the hooked knife (which we have shown in the engraving) was of great utility in cutting and fishing out parts of aquatic plants and submerged branches and roots, which are often teeming with microscopic life.

G. M. H.

### A Good Cement for Various Purposes.

Very often a form of cement is required around shops and mills for filling cracks in stone or brick work. New factories, especially, often develop awkward cracks between the window frames and the brick walls, and during the cold months the air entering here will largely reduce the coal pile. The *American Wood Worker* suggests the following:

Procure a lot of paint, old paint if possible, from a dealer, the skins forming on top of the paints, settlings from the bottom of paint pots, and, in fact, any refuse which contains oil, zinc, or other mineral body may be used for the purpose.

Reduce this mass, especially if hardened from continued standing exposed to air, to the consistency of cream by soaking in some cheap oil. Heating may be resorted to if the hard paints cannot otherwise be softened.

When the whole has become soft enough to be stirred into a homogeneous mass, more oil may be added and the whole worked through a sieve and then run through an ordinary paint mill.

A quantity of common whiting is next to be worked into the oil and paint, much in the way as when ordinary putty is to be made. The thickness of this putty, as we may now call it, should not be as dense as when used for glazing.

When the whiting has been thoroughly mixed in and the mass well worked over, add a quantity of good Portland cement, sufficient to bring the putty to consistency which will enable it to be handled readily.

When in this state, the putty may be worked into cracks in brick or stone work much as ordinary putty is used when allowed to set and harden, and it will become nearly as hard as iron, impervious to moisture and any reasonable degree of heat.

### Adulteration as Defined in Law.

According to the Massachusetts Adulteration Act, an article of food is deemed to be "adulterated" within the meaning of the act:

"1. If any substance or substances have been mixed with it so as to reduce or lower or injuriously affect its quality or strength.

"2. If any inferior or cheaper substance or substances have been substituted wholly or in part for it.

"3. If any valuable constituent has been wholly or in part abstracted from it.

"4. If it is an imitation of, or is sold under the name of, another article.

"5. If it consists wholly or in part of a diseased, decomposed, putrid, or rotten animal or vegetable substance, whether manufactured or not, or, in the case of milk, if it is the product of a diseased animal.

"6. If it is colored, coated, polished, or powdered, whereby damage is concealed, or if it is made to appear better or of greater value than it really is.

"7. If it contains any added poisonous ingredient, or any ingredient which may render it injurious to the health of a person consuming it."

### The Annealing of Tools.

Some tools, such as circular cutters, files, etc., after they are forged into the shape required, must have teeth cut into them. Before this can be successfully accomplished a preliminary process is necessary. Hammering or forging the steel into the shape required will have hardened the steel to such an extent as to make the cutting of teeth into it impossible or difficult. It must, consequently, be annealed. This process is a double process. The steel must be reheated as carefully as before, and afterward cooled as slowly as possible. Many tools are only required to be hardened on a small part of their surface, and it is important that the unhardened parts should possess the maximum amount of toughness with the minimum amount of brittleness that can be attained. These tools can also be annealed after they are forged. The process of annealing, or slow cooling, leaves the steel cross-grained, gives it its maximum of ductility, and causes it, in fact, to approach the properties of lead.—*The Ironmonger (London).*

### The English Fast Train Record.

During the recent railway racing to Edinburgh and Glasgow, the Northeastern Company made no change in their engines; the regular engines that had been on the Scotch service were used all the time, and in nearly all cases these were compound engines. They had a pretty heavy train throughout, and well filled with passengers and luggage. On the last day of the accelerated running, they ran into Edinburgh thirty-four minutes before time; the run was done from Newcastle to Edinburgh—125 miles—in 128 minutes, by compound engine No. 117. This is at the rate of 58·6 miles for the whole run, and beats the record.

## ENGINEERING INVENTIONS.

An improvement in railroads has been patented by Mr. Robert P. Faddis, of Socorro, New Mexico. This invention covers a succession of metallic frames or cribs fitted to receive the rail seats, connections between the frames or cribs arranged opposite each other, and also connections between the rails held in the opposite frames or cribs.

A car brake has been patented by Mr. John Walsh, of Mansfield, Ohio. The invention consists of a lever connected with the brake mechanism, and also pivotally connected with a buffer held to slide longitudinally on the under side of the car, and engaged by a weighted lever held on a car to be coupled, it being specially intended to apply the brakes automatically when two cars come together for coupling.

## AGRICULTURAL INVENTION.

A combined harrow, planter, and roller attachment for plows has been patented by Mr. Samuel B. Smith, of Salt Lake City, Utah Ter. A roller is applied to the rear end of the seed-box carrying frame, and adapted to actuate the seed slides, the frame having harrow teeth on its under side, while there is an adjustably applied draught connection between the attachment and plow.

## MISCELLANEOUS INVENTIONS.

An improved freezer has been patented by Mr. Theodore L. Delpy, of Paris, France. This invention covers a mechanism for agitating the freezing mixture and a liquid to be frozen in a suitable combined apparatus, while it is also specially adapted for cooling bottles, meat, and other articles.

A nut lock has been patented by Mr. Aaron C. Vaughan, of Shane's Crossing, Ohio. It consists of a concavo-convex nut, thin enough to have some spring, with a round threaded hole in the center, and an adjoining circular segmental hole cut entirely through the nut and opening into the bolt hole.

A writing pen has been patented by Mr. Conrad Seabaugh, of Austin, Texas. This invention provides a thimble-like sleeve, adapted to be easily applied to the index or forefinger, whereby pen holders may be dispensed with, the thimble to be made in various sizes, to fit a large or small finger.

A walking cane has been patented by Mr. George H. Coursen, of Baltimore, Md. This invention covers a novel construction whereby cigarettes and matches may be safely and conveniently contained and carried in an ordinary walking stick.

A lighting attachment for mirrors has also been patented by the same inventor. The invention provides a device specially adapted for use in connection with adjustable mirrors, whereby a lamp or candle will be retained in a vertical position when supported by the device, regardless of the angle or inclination in which the mirror may be placed.

An indicator for doors has been patented by Mr. John D. Vail, of Blairstown, N. J. It is a device for attachment to a door, to indicate whether a room is vacant or occupied, the invention covering novel features of construction and being an improvement on a former patented invention of the same inventor.

A portable extension ladder has been patented by Mr. Simeon Picke, of Lake Linden, Mich. This invention provides a light and strong construction, whereby a ladder may be quickly and conveniently elevated and inclined toward the upper stories of a building, the device being one which may be utilized as a fire escape.

A razor caster, for holding a barber's outfit of razors and shears, has been patented by Mr. John B. Parker, of Wardner, Idaho Ter. It consists of a frame having a series of radial wires, a marginal wire or ring, and an elastic band, in connection with a hollow conical shaped base, the construction being simple and inexpensive.

A scallop turner has been patented by Mr. William D. Hall, of Beloit, Wis. This invention covers a novel construction of machine, to facilitate various kinds of scallop work or beading, especially adapted for turning out the scallops on the flies of button boots or on gloves, or turning out the fingers of gloves, etc.

A coal drill has been patented by Mr. Warren C. Johnson, of Oskaloosa, Iowa. A sleeve is interposed between the sliding supports of the drilling apparatus, and a bolt passed through the supports and sleeve adapted to clamp the supports against the side bars of the frame of the drill, whereby the drill may be clamped at any desired elevation by tightening a bolt.

The manufacture of sodium forms the subject of a patent issued to Mr. Henry S. Blackmore, of Mount Vernon, N. Y. It consists in mixing together calcium hydrate, ferric oxide, sodium carbonate, and carbon, heating in a chamber, and collecting and condensing the vapors, mixing in proportions and proceeding after a manner described.

A belt clasp has been patented by Mr. Louis Sanders, of Brooklyn, N. Y. It is for use on belts usually worn by men and women, and is designed to effect a saving of the belt material, the device being such that no lap is necessary with its use, while a belt of any thickness may be easily adjusted and firmly retained in any desired position.

A door bell has been patented by Mr. William B. Atkinson, of Franklin, Ky. One or more pivoted hammers are made to revolve with the shaft which passes through a door, the hammers swinging freely and striking the gong by the action of gravity, the disk to which the hammers are pivoted, and the gong, being adjustable lengthwise on the shaft.

A letter box has been patented by Mr. Henry T. Sidway, of Chicago, Ill. This invention relates to street mail boxes having a mechanism indicating the times of collection, and operated by the door through which the mail matter is removed, the improvement providing for conveniently preventing the operation of the indicator by the door when not desired.

A vibrating propeller for boats has been patented by Mr. Daniel B. Rowland, of Mount Shasta, Cal. Propelling blades to the rear of the boat are pivoted to a bar movable in the direction of its length, the blades closing against the bar moving in one direction, and being extended by the resistance of the water when the bar is moved in the opposite direction.

A piano pedal manual attachment has been patented by Mr. Hartwell R. Moore, of Norwalk, Ohio. This invention provides pedal levers to be attached at pleasure, and especially adapted for an upright piano, to enable the performer to play the bass with the foot, and thus secure organ pedal practice, the attachment not interfering with the appearance or action of the piano.

A wagon brake has been patented by Mr. William H. McCowan, of Watertown, Ohio. The parts are so located as to bring the brakes in a convenient position to have a short range of movement in front of the wheels, the construction affording a strong leverage, and requiring but little power and a slight movement of the brake lever, while avoiding rattling and jar.

An ore roasting furnace has been patented by Mr. Albert C. Johnson, of Wilmington, Del. It is for desulphurizing copper ores, iron pyrites, gold-bearing sulphurets and other ores, and is provided with different compartments in which are placed raking bars of novel construction, the ore to be gradually moved from one compartment to the other and agitated in each compartment by the raking teeth or fingers, which also impart an outward or inward motion to the ore.



## Business and Personal.

*The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*



## Notes & Queries

### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Books** referred to promptly supplied on receipt of price.

**Minerals** sent for examination should be distinctly marked or labeled.

(1) J. H. M. writes: I have a plunge battery with solution of bichromate of potash, oil of vitriol, and water. It works, decomposing water for a minute, and then stops. What is wrong with it, and how would you rectify it? A. You will get much better results with two cells. Your E. M. F. is too low, and now is reduced by polarization.

(2) D. L. writes: Kindly inform me what chemicals I may use to extract the gummy matter from vegetable substances, so that all stickiness might be removed from them in preparing them for the market. A. Steaming and washing, treatment with caustic soda solution, or with chloride of lime, followed by washing, are among the treatments we would suggest. One of the three will undoubtedly do the work.

(3) H. E. A. writes: To what extent is water compressible? A friend of mine says that water is compressible to about half its volume. He says that he experimented by filling a section of pipe to its full capacity, and that he forced in a further (measured) quantity of ⅛ the full capacity of the pipe, and claims that this was owing to the compressibility of water. A. Water is slightly compressible, but it is doubtful if a pressure has ever been produced by man, or could be produced with the materials at his command, which would compress water more than an infinitesimal amount. Thus a pressure of one atmosphere will compress water about five one hundred-thousandths of its volume. Your friend's experiment was incorrectly performed.

(4) W. C. M.—For bluing gun barrels by staining: Dissolve 4½ ounces hyposulphite of soda in 1 quart water, also 1¼ ounces acetate of lead in 1 quart water. Mix the two solutions and bring to a boil in a porcelain dish or stone pot. Clean the gun barrel free from grease, oil, or varnish, warm the barrel and smear with the hot solution, using a piece of sponge tied to a stick. When color develops wash and wipe dry, finish with boiled linseed oil. You will find the receipt for browning gun barrels, as per U. S. Ordnance Manual, in SCIENTIFIC AMERICAN, December 5, 1885, in No. 18 of Notes and Queries.

(5) S. P. G.—There is no method of dyeing or coloring brass and copper below the surface. An improvement on japanning may be made by coloring the surface. A steel color on brass and copper is developed by boiling the article in a solution of arsenic chloride in water. The same with sodium sulphide causes a blue color. Platinum chloride to which a small portion of tin nitrate has been added gives a black color. These are only surface colors and will not stand severe wear, but by japanning upon them you may obtain a more durable surface than with japan alone.

(6) S. H. H. writes: The light on Cape Bonavista, Newfoundland, can be seen 35 statute miles. The curvature of the earth would be something over 800 feet. How are we enabled to see round this curve? A. The curvature of the earth and refraction, as counted from the topmast of a ship, say 85 feet high, is equal to a distance of 12 miles, which leaves 23 miles for the distance from the horizon to the Bonavista light. The latter must be 340 feet above the sea to complete the 35 mile sight. You are correct as to the height of line of sight for 35 miles. Refraction reduces the height to 681 feet.

(7) S. A. S. writes: I am making brass castings, and am having trouble with some of my heavy work being spongy. Am making new metal. A. You heat your metal too hot, so that it boils. Such metal always pours spongy. The copper should be brought down with old metal put into the pot with the copper. If you are making composition with a mixture of tin, a little tin or old composition should be placed in the pot with the copper. The furnace should be so managed that after the charge is fairly melted and stirred the pot should not stay in the furnace, but be drawn, and if too hot to make smooth castings, it should stand a few minutes, and be stirred until the heat falls to the proper temperature to pour. Castings should be gated up from the runner, which also prevents gas from being driven below the surface as by a down pour. In making 6 or 8 ounce yellow brass castings the bulk of the zinc should be put in the pot after it is taken from the furnace. Always use old metal to draw down the copper to a fluid state at as low a temperature as possible. Large castings should be poured with the coolest metal that will run and fill.

(8) C. L. P. G.—Unbalanced slide valves have the full steam pressure on their backs equal to the area of the exhaust port of the valve and the differential pressure due to mean engine pressure for the steam ports, causing friction and excessive wear. Balanced slide valves are so arranged in their construction as to have a counter opening at the back or its equivalent in the steam chest to relieve nearly all the pressure otherwise pressing the valve hard upon the seat or face of the cylinder ports. These valves allow of an easy movement with little wear, but are more complex and expensive than the plain valves. They are of many forms and mostly covered by patents, the piston valve being one of the forms largely in use now. The double poppet valve used in our river steamers is a nearly balanced valve. Some of the cylindrical rotary valves are also nearly balanced.

(9) J. D. K.—There was a time when steel for rails, tires, and axles was not made here equal in toughness to the English make. The tables have been turned, and now American rails, tires, and axles are fully equal if not superior to English make for toughness and durability, and at less than half the English price of six years ago. We find no complaints from the 775,000 tons of steel rails made in the United States during the first half of the present year and over a million tons made in the last half of 1887.

(10) J. H. McD.—For stopping the bleeding of a tree, heat a sad iron a little hotter than usual for ironing, put some resin, thick tar, or beeswax upon the cut surface, and melt it in by holding the hot iron on for some seconds, so as to heat the wood, that the resin or wax will stop the pores.—The expense of running a first class steam yacht varies greatly, as in ordinary use they are steaming only part of the time. While cruising, the expenses may run as high as $150 per day, or with economy they may be run for $100 per day.

(11) W. C. P. asks whether the ice in the great lakes melts or sinks in the spring of the year. A. The ice in late spring changes its concoidal form to acicular crystallization, absorbing water, or, in the common phrase, becomes water-logged and transparent. At this time it is so tender that the least wind breaks it up, when it floats as a mass of small crystals for a short time, and finally melts by the motion of the surface water bringing to the surface the warmer under

stratum of water. It does not sink in masses, as claimed by some.

(12) R. J. L.—Coal or gas tar makes a good roof paint. Mix with any cheap earth color, as pulverized slate, chrome yellow, etc. Thin with benzine.

(13) L. E. C. asks: The E. M. F. and the ampere or strength of current from an induction coil ¾ inch core, 4 layers of No. 15 primary. The secondary wire to be 20 layers of No. 30 wire, and would the current heat a small section of wire for canterizing? A. The current strength and E. M. F. would depend on the battery. The current would be of very slight quantity and high E. M. F., and would heat probably not one thousandth as much wire as would the original current. For canterizing use a heavy battery current applied directly without an induction coil.

(14) J. S. McC.—There is little or no difference in the crushing strength of short cylinders, say 2 or 3 diameters, whether solid or hollow. It is when of considerable length, as in supporting columns, that the hollow cylinder of equal weight supports the greatest weight by the bracing it receives from its cylindrical form. If a long solid cylinder is braced so as absolutely to prevent flexure in any part, it will be equal to a hollow cylinder of the same weight and length for resisting a crushing weight or pressure.

(15) L. I. O.—13 lb. of anthracite is equal to 1 gallon crude petroleum.

(16) H. W. N. asks how to make a good blacking for shoes; also how to make a good washing compound. A. There are several receipts for both purposes, many of which we have already published. For valuable information on these and many similar subjects see "Trade Secrets," which we mail for 60 cents.

(17) W. T. H.—For a black stain on iron mix 8 parts protochloride of antimony, 4 parts sulphuric acid, 2 parts empyreumatic pyroligneous acid, or gallic acid. Apply several coats of the mixture to the polished iron or until black enough, or paint with black japan varnish and bake hard. Then remove the polished surface with pulverized charcoal on a wet cloth.

(18) C. D. M. asks a recipe for removing the oil burned on the finished parts of an engine. A. Use caustic soda or potash. What this fails of removing, take off with a scraper.

(19) W. M. writes: I tin malleable iron, which comes from the bath nice and bright, but although I keep it covered, after a few days it gets red, copper colored in spots, and this color gradually spreads all over the work. Can you tell me the cause? A. The red color is probably derived from oxidation of the iron by the acid left in the pores of the iron. The acid rusts the iron and oozes out through the pores of the tin by the pressure due to increase of bulk by the action of the acid upon the iron; possibly also moisture may be absorbed by the acid through the tin, which is porous. Rinse the work, immediately after tinning, in boiling water, holding 2 oz. sal soda to the gallon in solution.

(20) J. J. H. asks the proper way to cure animal skins before the hair is dyed. A. Scrape the flesh side clean, and while they are moist (but not wet) rub in liberally a mixture of alum and salt, about one-half of each. Roll up, hair side out, for two to four days, then shake out and give another application, but with less salt. In two to four days more, according to size of skin, shake and beat out clean, and soften the skin by working it well over.

(21) W. H. E. asks: At what speed can a grindstone run, six feet diameter and ten inches thick, with perfect safety? A. 150 revolutions per minute.

(22) H. H. W. asks a good method for coating small castings of iron and brass with lead, also what is the technical name for this process? A. The process is called kalamein. Cast iron articles are galvanized in the regular way and then passed through a lead bath. Wrought iron and other metals may be either galvanized or tinned and then leaded.

(23) H. E. H. asks for a method by which he can find the point in an irregular triangle, from which as a center to inscribe a circle whose circumference will be tangent to each side of the triangle. A. Bisect any two angles of the triangle, prolong the bisecting lines until they intersect, and use their intersection as the center.

(24) R. W.—The tensile strength of wrought iron slightly increases with temperature from 60° (1) to 212° (1·2), and to 435° (1·4) of its initial tensile strength. This is no excuse for testing boilers with steam at a risk in case of rupture. We only repeat that there is no difference in a given pressure by whatever means it is procured.

(25) J. P. H. asks which would be the most efficient way to remove blood and grease stains from birds to be set up or stuffed. Also if it would be better to remove it before or after stuffing? A. Wash with pure water and keep agitating the feathers with the fingers until they are dry. This will remove blood. Similar treatment with benzine will remove grease. Do this before stuffing. It will undoubtedly injure the specimen to some extent.

## NEW BOOKS AND PUBLICATIONS.

WILD FOWL SHOOTING. By William B. Leffingwell. Chicago: Rand, McNally & Co.

This is a book made up principally of the personal experiences of the author, and they have been sufficiently extensive to make it a genuine pleasure to follow him, in its pages, through many delightful excursions often attended with much hard work and exposure, but generally resulting in the "bagging" of a good quantity of game. The resorts, habits, and flights of wild fowl are described, with the most successful method of hunting them, and much practical information is plainly set forth touching the right kind of boats to use and how to build and take care of them, about decoys and blinds, retrievers and their characteristics, and on the selection and use of a gun. The book cannot fail to be extremely valuable to every amateur, while its pages are full of entertainment to such as have been most successful in this class of sport.



# INDEX OF INVENTIONS

**For which Letters Patent of the United States were Granted**

**October 16, 1888,**

**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]

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